Perfusor® fm

Service Manual

Version 2.0 english

B|BRAUN
SHARING EXPERTISE

This Service Manual is valid for

Voltages 200 V to 240 V:	Order – No.
Perfusor® fm, German	871 5823
Perfusor® fm, French	871 5920
Perfusor® fm, Dutch	871 5939
Perfusor® fm, Italian	871 5963
Perfusor® fm, Danish	871 5831
Perfusor® fm, Norwegian	871 5840
Perfusor® fm, Swedish	871 5858
Perfusor® fm, Finnish	871 5866
Perfusor® fm, Spanish	871 5874
Perfusor® fm, Portuguese	871 5882
Perfusor® fm, English (BSI)	871 5890
Perfusor® fm, English	871 5904
Perfusor® fm, Turkish	871 5912
Perfusor® fm, Czech	871 5947
Perfusor® fm, Polish	871 5955

Voltages 100 V to 120 V:	
Perfusor® fm, English (BSI)	871 5815
Perfusor® fm, Dutch	871 5971
Perfusor® fm, Spanish	871 5980
Perfusor® fm, Kastelanisch	871 5998

This Service Manual is available under the following part number:

Designation	Part No.
Service Manual Perfusor® fm, english	8713 9117

Languages of this Manual

Designation	Part No.
Service Manual Perfusor® fm, german	8713 9116

The complete Service Manual contains the following pages:

Table of Contents 0

0 Table of Contents

Important Preliminary Remarks 0

Service Work

The present manual is for your information only. The possession of this manual does not authorize the performance of service work. Service tasks may only be executed by persons, who

- have received appropriate training on the system from B. Braun
- are included in the revision service
- possess the necessary test equipment and mechanical aids, and
- fulfill the personal requirements (training and knowledge).

Technical Safety Checks

The user is obliged to perform or to have performed the Technical Safety Checks on those medial products for which these checks have been prescribed by the manufacturer and to carry them out according to the indications of the manufacturer as well as the generally approved technical standards while adhering to the periods stated (§ 6 MP BetreibV).

B. Braun also recommends training on the Technical Safety Checks, or to perform at least the steps indicated in the current version of the manual, as:

- the TSC requires that the instructions in the manuals are observed
- the manuals are a reference for measurements
- depending on the unit type, the Service Program must be called which may lead to a dangerous unit condition in case of inappropriate operation. Furthermore, a special service connector may be necessary.

Current Versions

This manual version corresponds to the state when the manual was written. B Braun reserves the right to make technical modifications. The state of the revision is indicated by the index number in the footer of every page.

Revision Service

The possession of this manual does not automatically mean inclusion in the revision service. You will be included in the revision service after:

- technical training by B. Braun Melsungen or
- a written order placed with the sales department of B. Braun (fee required).

Responsibility of the Manufacturer

The manufacturer, person who assembles, installs or imports the device can only be held responsible for safety, reliability and performance if

- mounting, enhancements, new settings, changes or repairs are carried out by duly authorized persons,
- the electrical installation in the corresponding room meets the requirements of the VDE 0107, VDE 0100 part 710 or IEC 60364-7-710 and the national standards,
- the device is used in accordance with the instructions for use and the Service Manual,
- the Technical Safety Checks are performed at regular intervals,
- a current manual which corresponds to the revision state is used when carrying out maintenance, repair and service,
- the service technician takes part in the revision service,
- the technician has participated in a technical training course for the specific B. Braun unit.

Quality Management

B. Braun is certified in accordance with DIN EN ISO 9001 and ISO 13485. This certification also includes maintenance and service.

The unit has the CE label. The CE label confirms that the device corresponds to the "Directive of the Council for Medical Products 93/42/EC" of June 14, 1993.

Checks and Repair

Training may only be performed by B. Braun. The possession of the manual does not authorize the performance of repairs. The instructions on electrostatic sensitive components (ESD standards) must be observed.

After repair a device check or diagnosis is to be carried out.

Notes on ESD

Semiconductors can be destroyed by electrostatic discharge. Especially MOS components can be damaged by interference from electrostatic fields, even without discharge via contact. This type of damage is not immediately recognizable. Unit malfunctions can even occur after a longer period of operation.

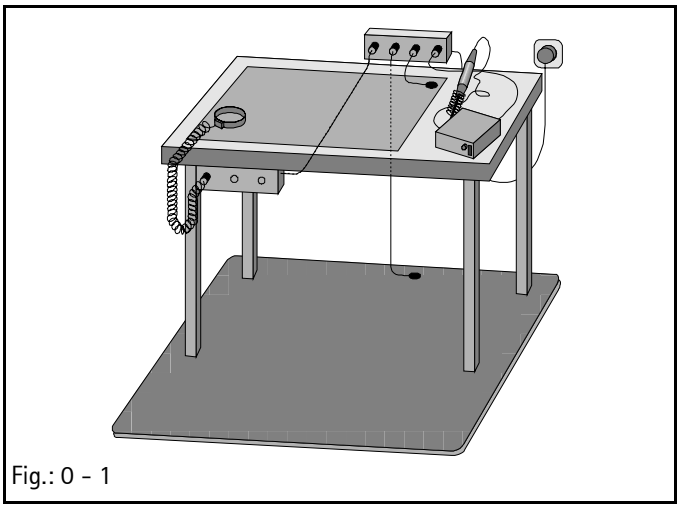


Fig.: 0 - 1

Each workstation must be equipped according to the recommendations with the necessary static protective measures, if ESD components or boards are handled.

Each workstation must be equipped with a conductive table surface. The conductive surface, the soldering iron or the soldering stations must be grounded via protective resistors.

Chairs must be of antistatic design. The floor or floor mats should be of electrically conductive material.

Personnel must wear conductive wristbands which are connected to a central ground potential via protective resistors, e.g. the ground contact of a wall outlet. Furthermore it is recommended that personnel wear cotton clothing and electrically conductive shoes to prevent electrostatic charge.

Spare Parts and Test Equipment

Only use original spare parts from the manufacturer. Do not tamper with assembly groups which can only be exchanged completely. The spare parts required are listed in Section 9.

Service personnel are responsible for the calibration of their test equipment. Original test equipment can be calibrated at the works of B. Braun. Further information is available upon request.

Setting Off

Additional notes and warnings are set off as follows:

Note

Is used for additional or special notes concerning information and working steps.

CAUTION

Is used for working steps which may result in damage to the unit, system or to a connected device.

WARNING

IS USED FOR WORKING STEPS WHICH MAY RESULT IN PERSONAL INJURY.

References to chapters are shown as follows
(see "Setting Off" ➨ pg. 0 - 8)

References to figures and tables are shown as follows
Fig.: 2 - 3 or Table 2 - 1

References to item numbers in figures are shown as follows (Fig.: 1 - 1 / Item 1)
In this case "Fig.: 1 – 1" is the figure number and "Item 1" the item number within the figure.

When the Service Manual is stored as pdf-file, these references are displayed green. Click with the mouse button on a reference to jump to the corresponding source.

Menu commands are described as:
Menu ***File***.

List of Abbreviations

Abbreviations which are not generally known, but are used in this manual, are listed below.

ESD	Electrostatic Discharge
PCA	Patient Controlled Analgesia
TSC	Technical Safety Checks
TEMP	Temperature

Contact Persons 0

Technical Training

Via local representative.

Entry for Technical Training

Application for a technical training course must be made via the responsible representative.

Ordering of Spare Parts and Test Equipment

Please contact your local B. Braun subsidary.

International Technicians (Intercompany)
Nadja Machal
Fax: +49 5661 / 75 -47 89
e-mail: nadja.machal@bbraun.com

Service Hotline

Karl Tippel, Tanja Kördel
Phone: +49 5661 / 71 - 35 25
Fax: +49 5661 / 71 - 35 26
e-mail: karl.tippel@bbraun.com
e-mail: tanja.koerdel@bbraun.com

Return of Spare Parts and Test Equipment

B. Braun Melsungen AG
Schwarzenberger Weg 73-79
Wareneingang Werk C
34 212 Melsungen
Germany

Safety Officer (§ 30 MPG)

Dr. Ludwig Schütz
e-mail: ludwig.schuetz@bbraun.com

Translation

PAS GmbH, Brückner GmbH, Germany

For your notes:

System Overview 1

Physical Construction

The Perfusor® fm is a compact stackable syringe pump. It provides high precision delivery for the administration of small and large volumes.

- Standard delivery range: 0.1 ml/h to 200 ml/h
- The adjustable maximum value (max. 999.9 ml/h) can be changed in the Service Program.
- The unit is operated via the membrane keyboard.
- Display via LED- and LCD-display, as well as 4 light emitting diodes.
- Semiautomatic syringe change.
- Functional sequence and monitoring microprocessor controlled.

The unit can be retrofitted with memory cards for extended application (extension port available). Switching between the standard and extended operating modes is possible with the keypad.

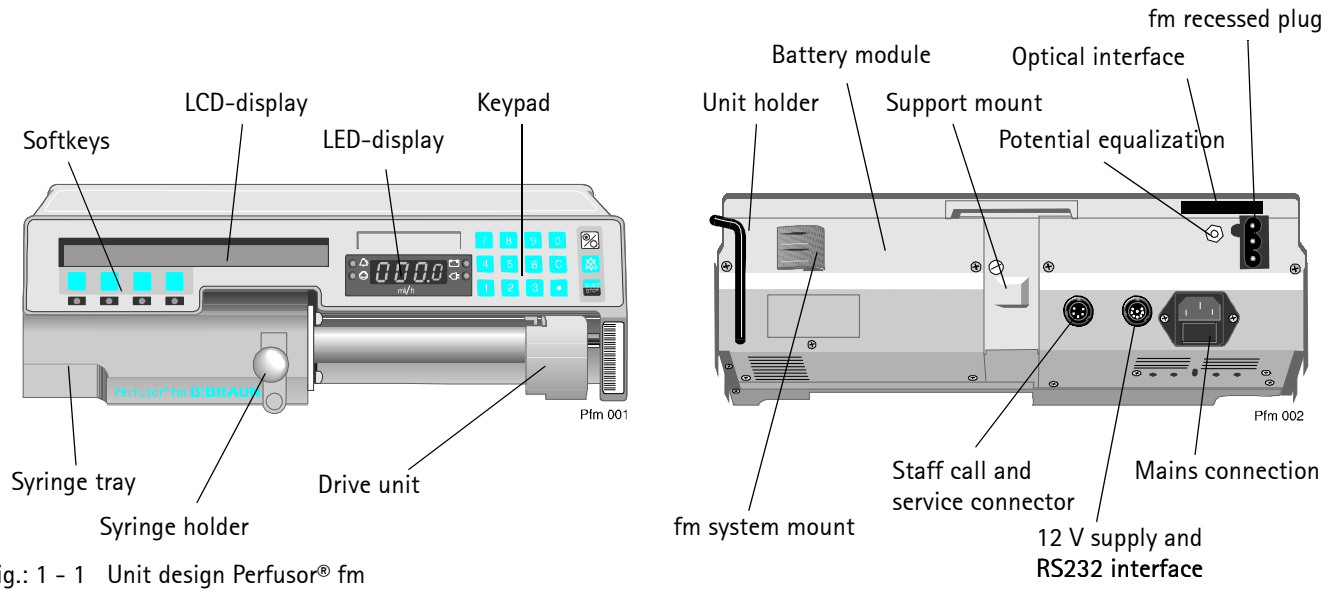
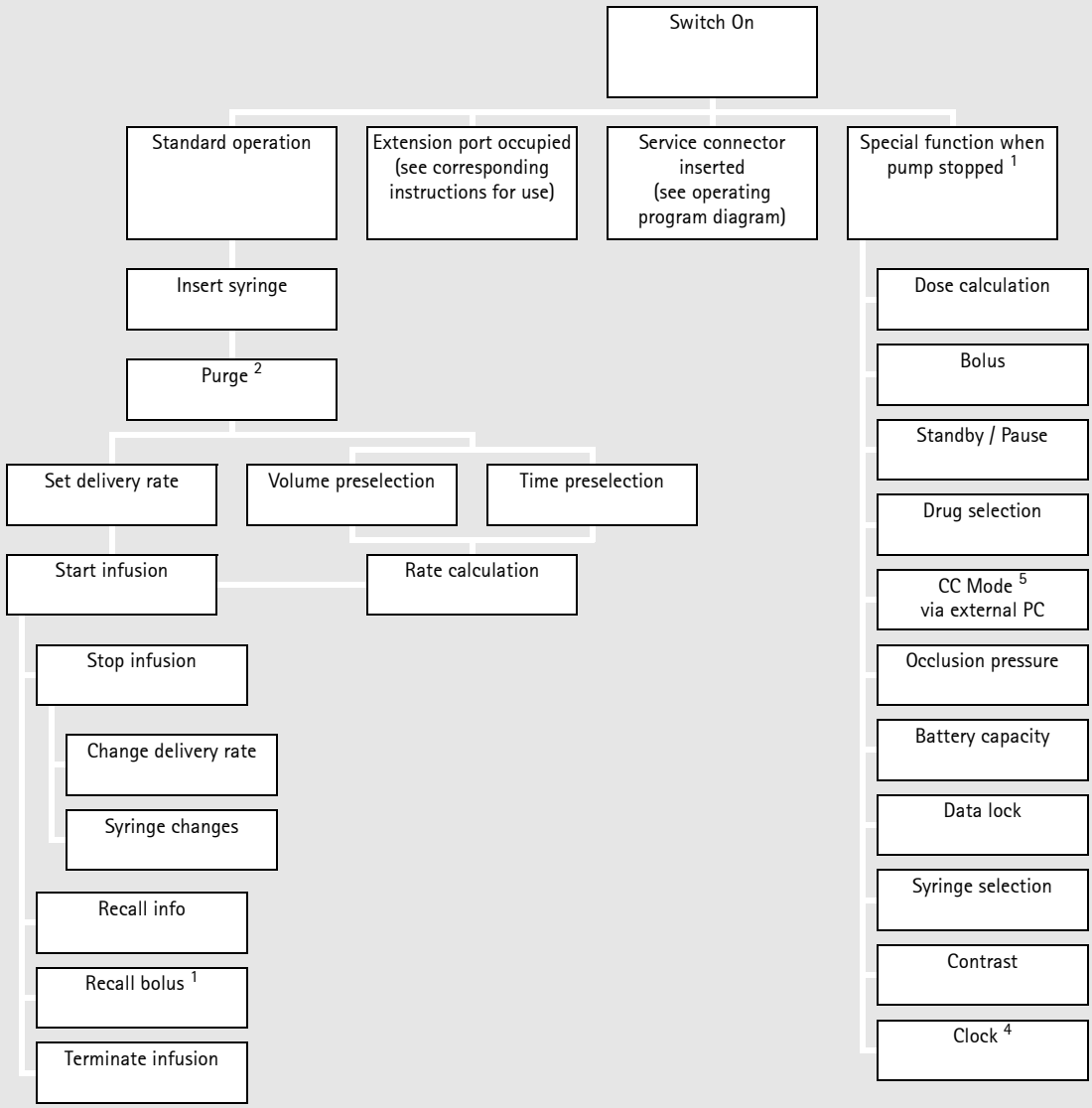


Fig.: 1 - 1 Unit design Perfusor® fm

Operation Flow Chart



1 Function only available if enabled in the Service Program.

2 Can be disabled in the Service Program from software version PFAC on.

3 From software version PFAD00001 on

4 From software version PFAD00002 on

5 Not available from software version PFAE00002 on

Fig.: 1 - 2

See instructions for use for detailed information.

Function

Two independent software-controlled microprocessor systems control and monitor the hardware. On the basis of their functions, they are defined as a control microprocessor and function processor. Both systems work with independent clock frequencies and have access to different program and data memories. All safety-relevant functions are handled by both processors and the results are counter checked (CF- and FC-latch).

The design of the Perfusor® fm is shown in the block diagram (Fig.: 1 - 3).

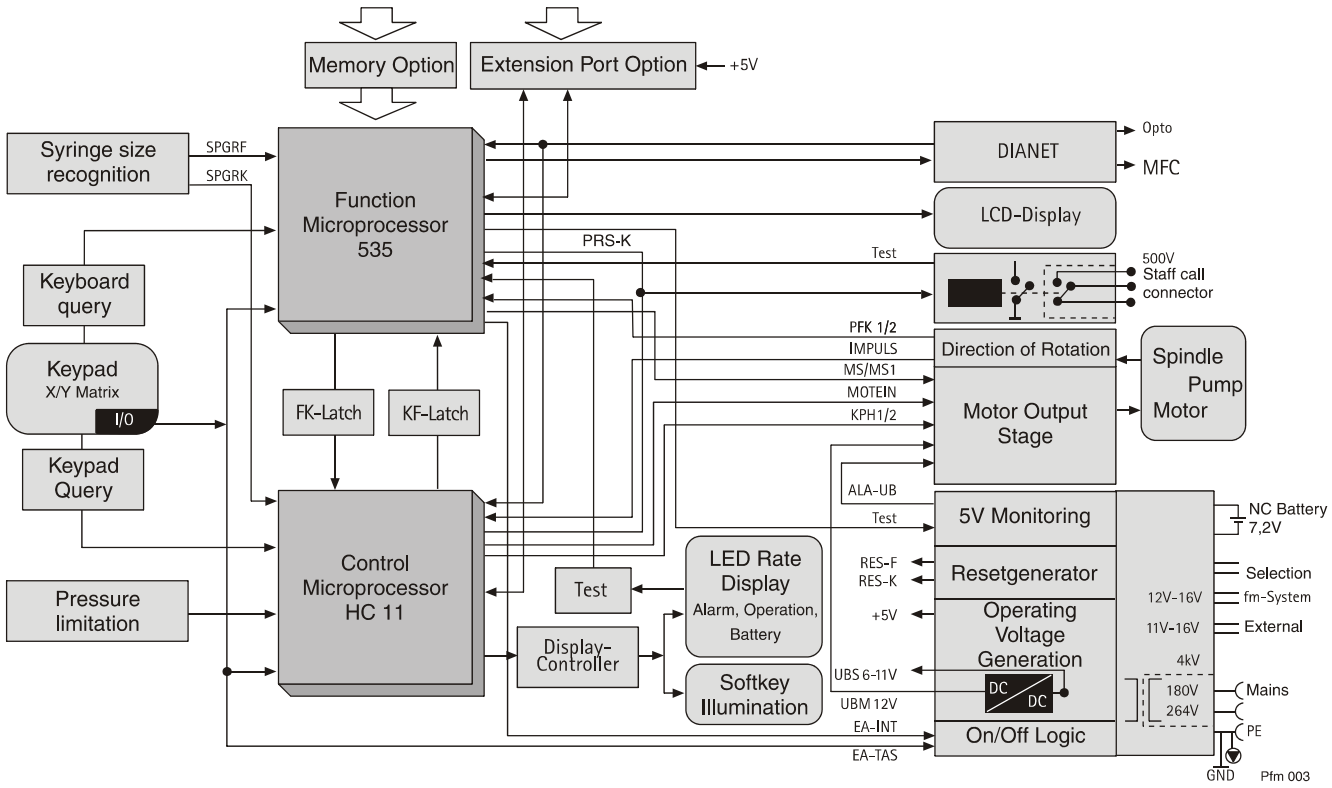


Fig.: 1 - 3

Internal Connection Diagram of Boards (PCBs)

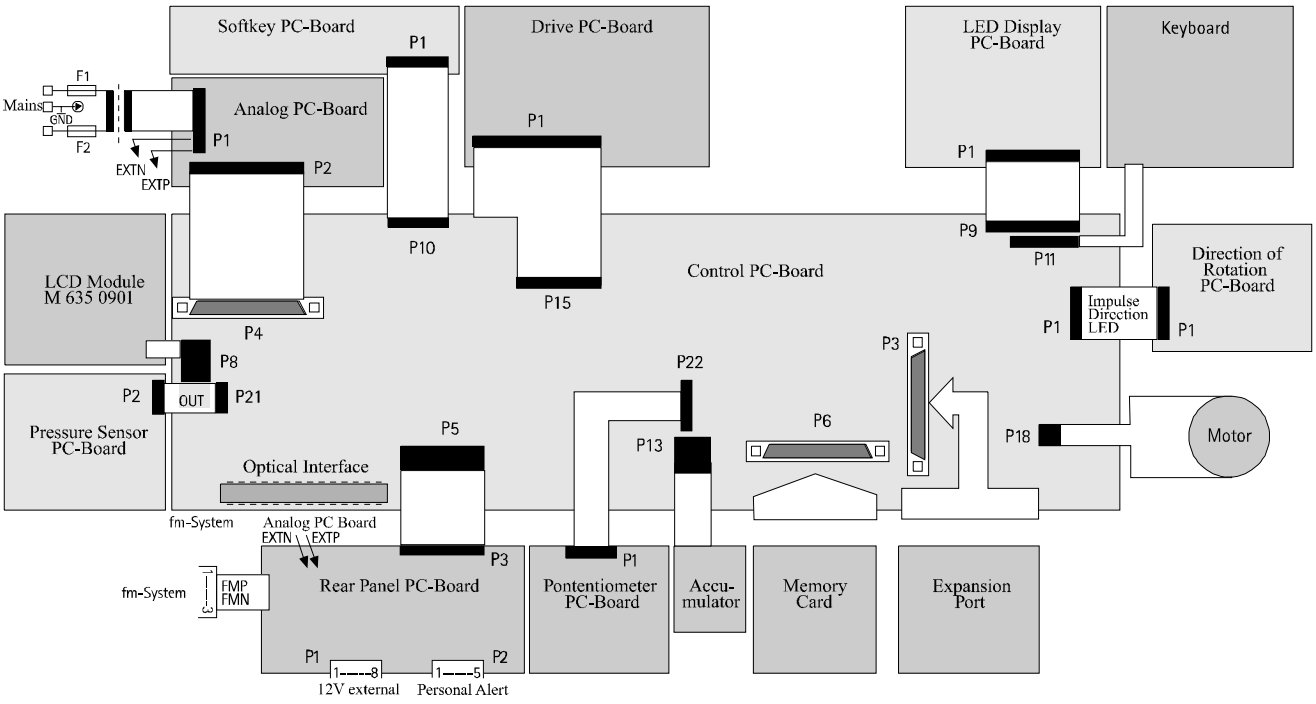


Fig.: 1 - 4

Motor Control

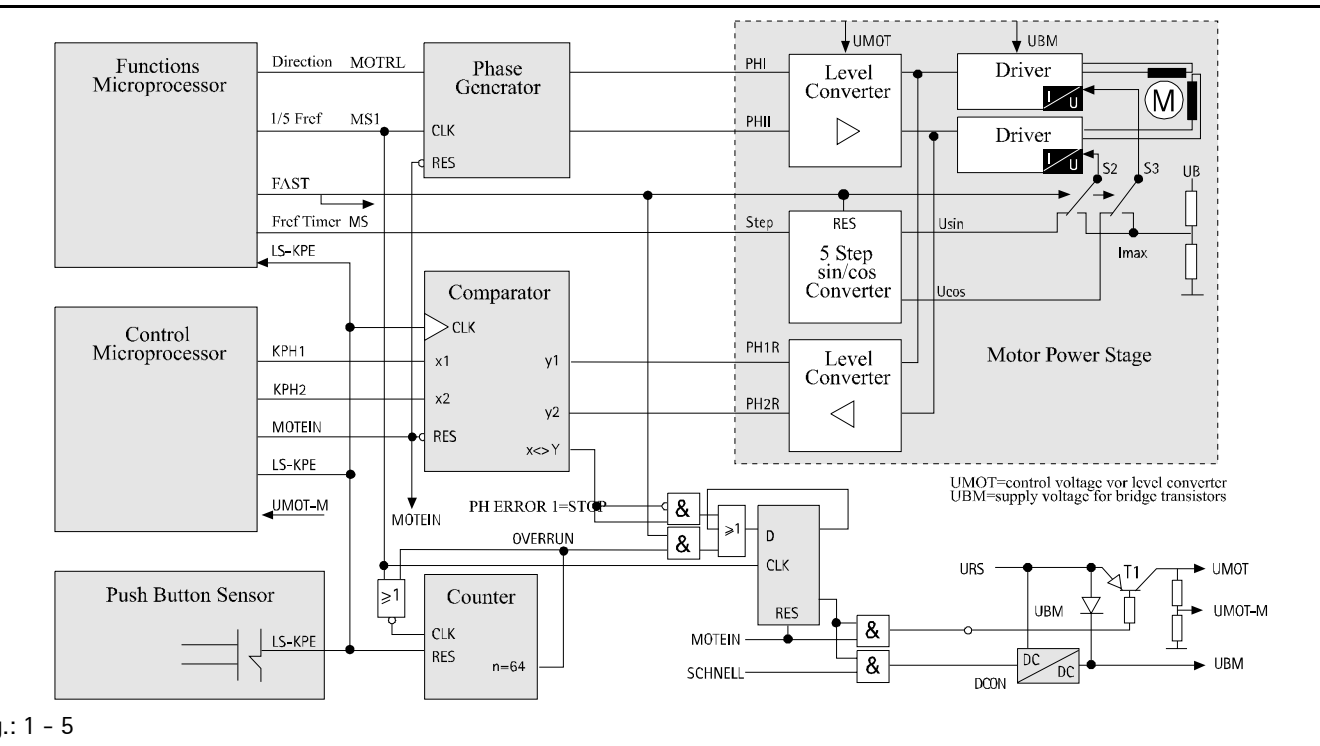


Fig.: 1 - 5

Drive

The drive consists of the drive unit with claw drive motor and push-button sensor, and the stepper motor which is connected to the drive unit via a toothed belt.

The pump motor can run in pump mode and syringe change mode (backward and forward fast mode).

- Motor operation: fast mode

The comparator is switched off in fast mode, because a set phase position is not specified. The current supplied to the drivers are switched to I max. by the (FAST) signal and the sin/cos converter is by-passed. In forward operation the drive advances until the push-button sensor is initiated. The comparator is replaced by a counter, which limits the motor steps to max. 64 after the push-button sensor has been touched. The remaining brake path is accomplished in micro step operation. In the event of an error, the syringe is thus not emptied during a syringe change. The level converter switches the (OVERRUN) signal off after recognition of the push-button sensor. The correct shut-down of the fast mode is accomplished via the sensor, as well as the control and function microprocessor. The function of the push-button sensor and switching off of the counter is only tested for the first syringe change after switch-on.

The motor is turned reverse in micro-steps in the reverse mode. The actual phase position (KPH I) is compared with the set phase position (KPH II). If the signals are consistent, the (MS1) voltage is applied to the drivers via T1. If the push-button leaves the sensor, the full step mode is activated via the (FAST) signal and the motor is accelerated to maximum frequency.

- Motor operation: pump mode

The motor is driven with 48 steps per revolution in bipolar mode by the motor output stage. Each complete step is subdivided into 5 micro-steps. The timer of the function microprocessor generates the five-fold step change frequency (MS-A and MS-B) as a PWM signal as a reference signal for the motor current comparator. After each fifth micro-step a positive edge (MS1) is sent to the phase generator.

The phase generator generates the phase position of (PH I) and (PH II) for the current direction of the motor winding. (MOTRL) activates reversal of the motor.

The position of the motor from the output stage is fed back to the hardware comparator as (PH1R) and (PH2R) signal for the recognition of a possible drive error. The actual and the set position

(KPH1) and (KPH2) of the control microprocessor are compared at each phase change. (UBS) is switched via a transistor as (UMOT) voltage to the level converter only if these signals are consistent. The switch-off capability of the comparator is tested and monitored by the (UMOT-M) signal.

- Malfunction behaviour

If overdelivery occurs, reaction time is less than 10 msec at the highest rate. The motor is switched off by an external hardware comparator after registration of the first micro step error. If shut-down occurs after a full step error (drive unit ratio of 104 steps per millimeter and syringe with a maximum diameter) a maximum error volume of 6.3 microliters can be delivered. This is equivalent to 6.3% of the volume per hour at a delivery rate of 0.1 ml/h.

This allows a reaction during the drive of the motor output stage even for the worst case (short of both microprocessors and the data bus).

The comparator blocks the output stage, if the set phase position deviates from the actual phase position. Thus the comparator is a second independent shut-down device in case of an error. The comparator is also tested during the switch-on test.

Push-Button Sensor

The push-button sensor prevents a premature emptying of the syringe during a syringe change. The recognition of the syringe by the push-button sensor allows a controlled braking of the pump motor as well as control of the claw holders. Operating principle: see figure.

- Exchange:

The push-button sensor is a part of the drive unit and cannot be replaced separately.

- Test:

The freedom of movement of the sensor button is tested in the drive test prior to the syringe "search". This assures that a positive contact of the sensor button with the control plate is detected and that the clamp claws function.

If a syringe is not inserted the sensor button is held by a spring membrane at a distance of approx. 2 mm from the point of the initial mechanical force.

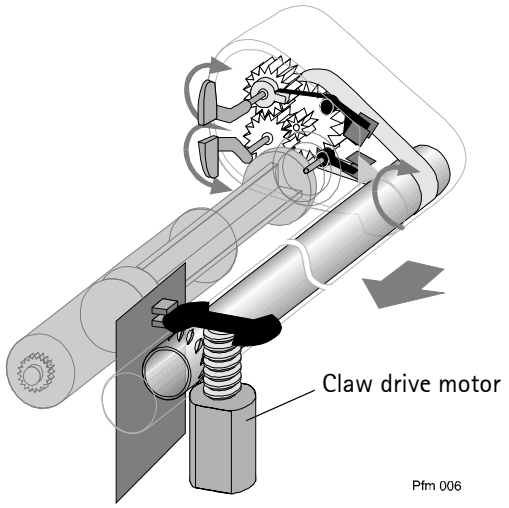


Fig.: 1 - 6

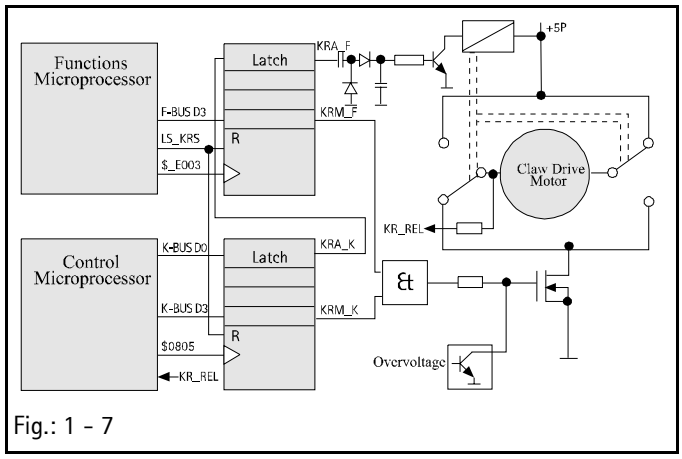


Fig.: 1 - 7

During the test sequence the drive unit is advanced to its rear end position. The clamp claws are closed to the extent that the sensor button light barrier is darkened. The claw motor light barrier counts the number of revolutions between "claw open" and mechanical blocking of the worm wheel by the initial force of the sensor button. The number of revolutions must be in a plausible range. Then the clamp claws are driven again to the "open" position.

- Clamp claw control during malfunction:

A malfunction of the clamp claws to the "claw open" position could lead to an emptying of the syringe due to negative pressure. To avoid this, the claw drive motor can only be moved in the direction "claw closed" after a "single fault" (e.g. short at the drive transistor). An opening of the clamp claws due to a "single fault" can be excluded. A double channel, dynamic diversity signal is generated for reversal of the direction of rotation. Driver effectiveness is tested during the switch-on test.

Accessories

Designation	Ord. No.
Unit connecting lead 200-240 V	3450 2718
Unit connecting lead 100-120 V.	3450 5423
Pole clamp	3450 9054
Universal clamp, complete	3450 5857
PCA-Module installation kit (cpl.)	0871 6013
consisting of:	
PCA memory card	3450 7990
PCA extension board	3450 7981
Patient button connection board	3450 7973
PCA patient button	3450 7949
PCA configuration connector	3450 7957
History module	0871 4878

For your notes:

Software Update

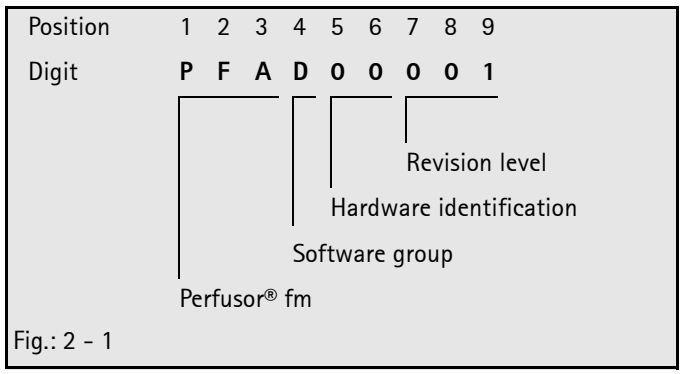


Fig.: 2 - 1

Designation	Ord. No.
Update Kit PFAD00004	3450 9046
Update Kit PFAE00004	3450 904B
Update Kit PFBD00001 (for PCA)	3450 6322
Update Kit PFBE00001 (for PCA)	3452 1283
Interface line	0871 1658

The higher digit always replaces the lower digit for the revision level, e.g. PFAE00004 replaces PFAE00002.

Units with an old software version, e.g. PFAC00002 can be updated to the new software version PFAE00004.

When the software group changes (Fig.: 2 - 1) the unit functions are changed, too. Therefore unit users must be informed (e.g. instruct the user and exchange the instructions for use – software coding (e.g. PFAE) is to be found on the cover page of the instructions for use.)

Note

Mark the unit after having updated the software! The new software version must be clearly recognizable.

Only update from old to new software versions, never in reverse order (e.g. never update from PFAD00001 to PFAC00002!).

All units used in one ward should have the same software status and basic setup to avoid operator mistakes.

Note

Software updates must be reported to B. Braun for registration. Observe the notes of the update program and the supplements!

2 Software

Compatibility

Combination of the software Perfusor® fm and PCA Module

Perfusor® fm	PCA Module
PFAB00001	PFBC
from PFAB00002 on	PFBD
from PFAD00004 on	PFBD / PFBE

Table 2 - 1

Note

The software PFBC of the PCA Module can be updated to PFBD and thereafter to PFBE (not directly from PFBC to PFBE) via PC, if required. The software must be compatible with the unit software.

Note

From unit software version PFAD00002 on a History module can be installed.

Approved Software Versions

Software PFAAxxxxx

This version was recalled for safety-technical reasons and was replaced by software version PFAB00001 or PFAC00002.

Software PFAB00001

Basic software

Software PFAC00002

Expanded / changed functions:

- Online rate setting (can be released in Service Program).
- Bolus function either with volume limitation or without volume limitation by actuating two keys.
- Interval bolus function (can be released in Service Program).
- Bolus rate can be set to 1800 ml/h.
- Time for syringe pre-alarm (can be selected between 3 and 30 minutes in the Service Program).
- Drive test only once when the unit was switched on.
- AAAA flashes on the LED-display in case of an alarm.
- Display of operating hours in special function "Battery capacity".

- Purge function can be activated and deactivated in the Service Program.
- Double rate input (can be released in Service Program).
- The Service Program was expanded by sub-items 0370 (menu) and 0380 (syringe pre-alarm time).

Software PFAD00001

Expanded functions:

- Special function Dose Calculation
- Additional display operating hour counter in INFO, SM, Battery, PASSIVE mode
- Dianet proposal data even during running infusion.

Changes:

- Special function Bolus changed.

Software PFAD00002

Expanded functions:

- Protocol function with History memory card
- Special function clock

Software PFAD00003

Expanded functions:

- Staff call with switch-on impulse which can be deactivated
- History module with "hold syringe", "detach syringe"
- Storage of alarms in case of malfunctions, which can be recalled in the Service Program menu 230
- Selectable switch-on impulse
- Unit alarm 160 = defective membrane keyboard

Changes:

- Improved electromagnetic compatibility (EMC)

Software PFAD00004

Expanded functions:

- Test of claw holder (enlarged time tolerance)

Software PFAE00002

Expanded functions:

- Special function Dose Calculation: Concentration and dose rate are saved when the unit is switched off (also without

Data Lock). Change of online rate and bolus dose also possible in dose calculation.

- Staff call at pre-alarm can be switched off in menu 330 of the Service Program.
- With test adapter the battery capacity display switches between the nominal and the actual capacity.
- Duration of the Dianet^{Star}-mode display can be set in menu 390 of the Service Program.
- DIANET address for PCA can be defined in menu 150 of the Service Program.
- New syringes.
- Unit alarm 079 = LCD-busy signal missing.
- Unit alarm 180 = FMEA test variables for Dianet^{Star} in an illegal condition.

Changes:

- Communication protocol DIANET replaced by Dianet^{Star}.
- Volume / time pre-selection is counted down.
- Special function standby, simplified operation procedure (without intermediate steps).
- Enhanced battery trickle charge.
- Changed syringe names.

Software PFAE00003

Changes:

- Special function Dose Calculation:
  Weight and dose rate are automatically deleted when concentration changes.

Software PFAE00004

Expanded functions:

- Cyclical battery test
  (For improved recognition of defective battery cells the modification instructions „Cyclical battery test" Ord. No.: 3452 0848 can be used.)

Language Groups

Language Group A:

German, French, Dutch, Italian

Language Group B:

English, Dutch, Spanish, Castellano (PFAC)

English, Dutch, Spanish, English (PFAD)

Language Group C:

Danish, Norwegian, Swedish, Finnish

Language Group D:

Spanish, Portuguese, English, Turkish

Language Group E:

Czech, Polish, German, English
(from software PFAE00003 on German was replaced with Hungarian)

Error Messages and Alarms

Alarms of the function processor MP 535 are displayed on the LCD-display. Alarms of the control microprocessor HC11 are displayed on the LED-display. The alarms help to troubleshoot unit malfunctions. As not all malfunctions can be considered, unit malfunctions with different messages, which are not listed, can be displayed, or there may be no message.

Error Messages Basic Unit
Software PFAC, PFAD, PFAE

Function Processor MP 535

LCD-Display	Description
001	UMOT cannot be switched on
002	UMOT still switched on despite overvoltage
003	UMOT still switched on despite MOTEIN=0
004	UMOT still switched on despite undervoltage
005	Defective RAM memory U13
006	Defective program memory U75
007	EEPROM calibration data error
008	Different program versions of the processors MP 535 and hc11
009	PR is active in spite of different signals on microprocessor hc 11 and 535. PR 80c535 inactive and PR 68hc11 active.
010	Defective LED-display
011	Defective LED-display
012	Defective LED-display
013	Defective LED-display
014	Defective LED-display
015	Defective LED-display
016	Defective LED-display
017	Defective extension port / inserted extension card without memory card
041	Light barrier claw cannot be switched off
043	Defective monitoring LS_KPE of dynamics
045	Number of claw revolutions not plausible
070	Defective LS push-button
071	ON/OFF key pressed longer than 14 sec
072	Defective program flow

Table 2 - 2 (Abschnitt 1 von 2)

LCD-Display	Description
073	Different keyboard gaps between 80c535 and 68hc11
074	Testbit!=0 out of switch-on test
076	Defective program memory
077	Defective program memory
078	Reset during active operation (from software PFAD00003 on)
079	LCD-busy signal missing (from software PFAE00002 on)

Table 2 - 2 (Abschnitt 2 von 2)

Control Microprocessor HC11

LED-Display	Description
100	Defective U63, RAM test shows error
101	Defective U43 program memory, ROM test error 1
102	Defective U43 program memory, ROM test error 2
103	Calibration data error from EEPROM
104	Power supply test
105	Battery not present / missing battery charge current
106	Defective extension port
107	End boot program is reached
108	Identification error between board 80c535 and 68hc11
120	100 msec loop interrupted
121	1 msec clock out of tolerance
122	1 msec clock missing
123	Reset during active operation
124	Wrong direction of rotation of drive
125	Drive has not stopped
126	Drive too fast
127	Defective dynamic pressure sensor
128	Monitoring of drive detects error
129	Monitoring claw control
140	Push-button sensor defective
141	Faulty process drive test, test sequence
142	Drive, claw light barrier
143	Motor not on, UMOT not present
144	Motor shut-down U11 does not switch off UMOT

Table 2 - 3

LED-Display	Description
145	Phase comparator U12/U34/U64
146	Closing of claw relays not plausible
147	Defective claw motor switch-off path KRM_F
148	Defective claw motor switch-off path KRM_K
149	Defective claw motor switch-off path KRA_K
160	Defective membrane keyboard
180	FMEA test variables for Dianet^{Star} in an illegal condition (from software version PFAE00002 on)

Table 2 - 3

Error Messages with PCA Module
Software PFBD, PFBE

Function Processor 535

LCD-Display	Description
0001	UMOT cannot be switched on
0002	UMOT still switched on despite overvoltage
0003	UMOT still switched on despite MOTEIN=0
0004	UMOT still switched on despite undervoltage
0005	Defective RAM memory U13
0006	Defective program memory U75
0007	EEPROM calibration data error
0008	Different program versions of processors 68hc11 and 80c535
0010	Defective LED-display
0011	Defective LED-display
0012	Defective LED-display
0013	Defective LED-display
0014	Defective LED-display
0015	Defective LED-display
0016	Defective LED-display
0017	Defective extension port / inserted extension card without memory card
0041	Light barrier claw cannot be switched off
0043	Defective monitoring LS_KPE for dynamics
0045	Number of claw revolutions not plausible
0070	Defective LS push-button

Table 2 - 4

LCD-Display	Description
0071	ON/OFF key pressed longer than 14 sec
0072	Defective program flow
0073	Different keyboard gaps between 80c535 and 68HC11
0074	Testbit!=0 out of switch-on test

Table 2 - 4

Control Microprocessor HC11

LED-Display	Description
0100	Defective U63, RAM test shows error
0101	Defective U43 program memory, ROM test error 1
0102	Defective U43 program memory, ROM test error 2
0103	Calibration data error from EEPROM
0104	Power supply test
0105	Battery not present / missing battery charge current
0106	Defective extension port
0107	End boot program is reached
0108	Identification error between board KuP and FuP
0120	100 msec loop interrupted
0121	1 msec clock out of tolerance
0122	1 msec clock missing
0123	Reset during active operation
0124	Wrong direction of rotation of drive
0125	Drive has not stopped
0126	Drive too fast
0127	Defective dynamic pressure sensor
0128	Monitoring of drive detects error
0129	Monitoring claw control
0140	Defective light barrier push-button
0141	Faulty process drive test, test sequence
0142	Drive, claw light barrier
0143	Motor not on, UMOT not present
0144	Motor shut-down U11 does not switch off UMOT
0145	Phase comparator U12/U34/U64
0146	Closing of claw relays not plausible

Table 2 - 5 (Abschnitt 1 von 2)

LED-Display	Description
0147	Defective claw motor switch-off path KRM_F
0148	Defective claw motor switch-off path KRM_K
0149	Defective claw motor switch-off path KRA_K
1100	Defective external RAM
1101	Wrong EPORT address
1102	Hardware basic unit – memory card not compatible
1103	Software basic unit – memory card not compatible

Table 2 - 5 (Abschnitt 2 von 2)

Drive Error Conditions

The error condition is displayed on the top right of the LCD-display with inserted service connector only when a syringe is got or released.

LCD-Display	Description
E=0	without error
E=1	Claw error
E=2	Drive error not 0 position
E=3	Push-button not free
E=4	Push-button free
E=5	Claw revolutions test for syringe type
E=6	LS 0 position not free
E=7	No syringe detected
E=8	Drive test, light barrier push-button 1. not free in 0 position 2. indicates free, although claw push-button activated
E=9	Error drive with software PFAB, claw not open in forward feed
E=10	Forward key was not actuated for 3 sec

Table 2 - 6

Alarm Causes

1. Occlusion Alarm

Occlusion?

Lay line without any kinks and check integrity of complete infusion line. Bolus is automatically reduced.

Press START to restart infusion.

2. Battery Alarm

Battery alarm or battery pre-alarm?

Battery pre-alarm 3 min before battery is discharged. Then battery alarm:

Switch device off, connect to mains.

3. Syringe Alarm

Malfunction during syringe change? Manipulation of the syringe holder when syringe is administered?

Pull syringe holder.

Syringe pre-alarm?

3 to 30 min before syringe is empty.

Note

Time can be set by Service.

4. Standby Alarm

Alarm after set PAUSE has expired?

Stop PAUSE: Press key below END.

Extend PAUSE: Press key below ON.

5. Further Alarms/Displays

No rate?

Set rate.

Defective unit?

Switch off and start again.

If renewed alarm, call Service.

Software Default Values

Unit No.: _____

	Menu Item	Default	Customer Setting
Standard function	Service language	English or German	_____
	User language	Country language	_____
	Alarm type	Single stage	_____
	Staff call	Dynamic without OFF alarm, switch-on impulse switched off	_____
	Max. rate	200 ml/h	_____
	Ward identification	Blank	_____
	Drug 0	Blank	_____
	Drug 1 ... 9	Drug 1 ... 9	_____
	Operating alarms	0	_____
	CC address (only PC)[6]	1	_____
	DIANET mode display[6]	60 seconds	_____
Special functions	Dose calculation[1]	Off	_____
	Bolus function	On	_____
	Standby	On	_____
	Drug selection	Off	_____
	CC address[2.5]	Off	_____
	Occlusion pressure	On	_____
	Battery capacity	Off	_____
	Data lock	Off	_____
	Syringe selection	Off	_____
	Contrast	Off	_____
	Clock[2]	Off	_____
SM menu	Interval bolus dose	Off	_____
	Purge key	On	_____
	Online rate setting	On	_____
	Double rate entry	Off	_____
User data	Occlusion pressure	Stage 4	_____
	Contrast	4	_____
	CC address[5]	1	_____
	Drug	0	_____
	Data lock	Off	_____
	Standby time	24h00m	_____
	Bolus key[5]	On	_____

	Menu Item	Default	Customer Setting
	Last 50 ml syringe	50 ml Perfusor	
	Last 20 ml syringe	20 ml Perfusor	
	Last 10 ml syringe	10 ml Perfusor	
	Bolus rate	800 ml/h	
	Bolus volume[3]	0 ml	
	Syringe pre-alarm	3 min	
Syringe selection	50 ml Perfusor	On	
	50 ml Proinjekt	On	
	50/60 ml Terumo[5]	On	
	50/60 ml Terumo EU[6]	On	
	50/60 ml Monoject EU[6]	On	
	50/60 ml Monoject US[6]	On	
	50/60 ml Sherwood[5]	On	
	50 ml Omnifix	On	
	50 ml B-D Plpak 308500[5]	On	
	50/60 ml B-D Plpak[6]	On	
	50/60 ml Euroject[6]	On	
	20 ml Perfusor	On	
	20 ml Omnifix[1]	On	
	20 ml B-D Plpak 300913[5]	On	
	20 ml B-D Plpak EU[6]	On	
	20 ml Terumo[6]	On	
	20 ml Monoject EU[6]	On	
	20 ml Monoject US[6]	On	
	12 ml Monoject EU[6]	Off	
	12 ml Monoject US[6]	Off	
	10 ml Omnifix	Off	
	10 ml B-D Plpak 300912[5]	Off	
	10 ml B-D Plpak[6]	Off	
	10 ml Terumo[6]	Off	
Calibration data	Length (L)	Depending on unit[4]	
	Brake path (B)	Depending on unit[4]	
	Y1 (force)	Depending on unit[4]	
	Y2 (force)	Depending on unit[4]	
	Potentiometer	Depending on unit[4]	

	Menu Item	Default	Customer Setting
Unit specific data	DIANET type no.	Depending on unit	_____
	Serial no.	Depending on unit	_____
	Operating hours	Depending on unit	_____
	Battery hours	Depending on unit	_____
	Number of syringe changes	Depending on unit	_____

[1] from software PFAD00001 on
[2] from software PFAD00002 on
[3] only software PFAC00002
[4] Calibration data is generated by calibration. - There are no calibration data available for the drive on new controller boards (display: "defective"). After assembly the drive must be calibrated in the Service Program.
[5] Not available from software version PFAE00002 on
[6] from software version PFAE00002 on

Structure of the Service Program

The figure and description of the Service Program refers to unit version V 00.07, -.08, or -.10. If additional memory cards are used (e.g. PCA) the functions are extended (see additional information).

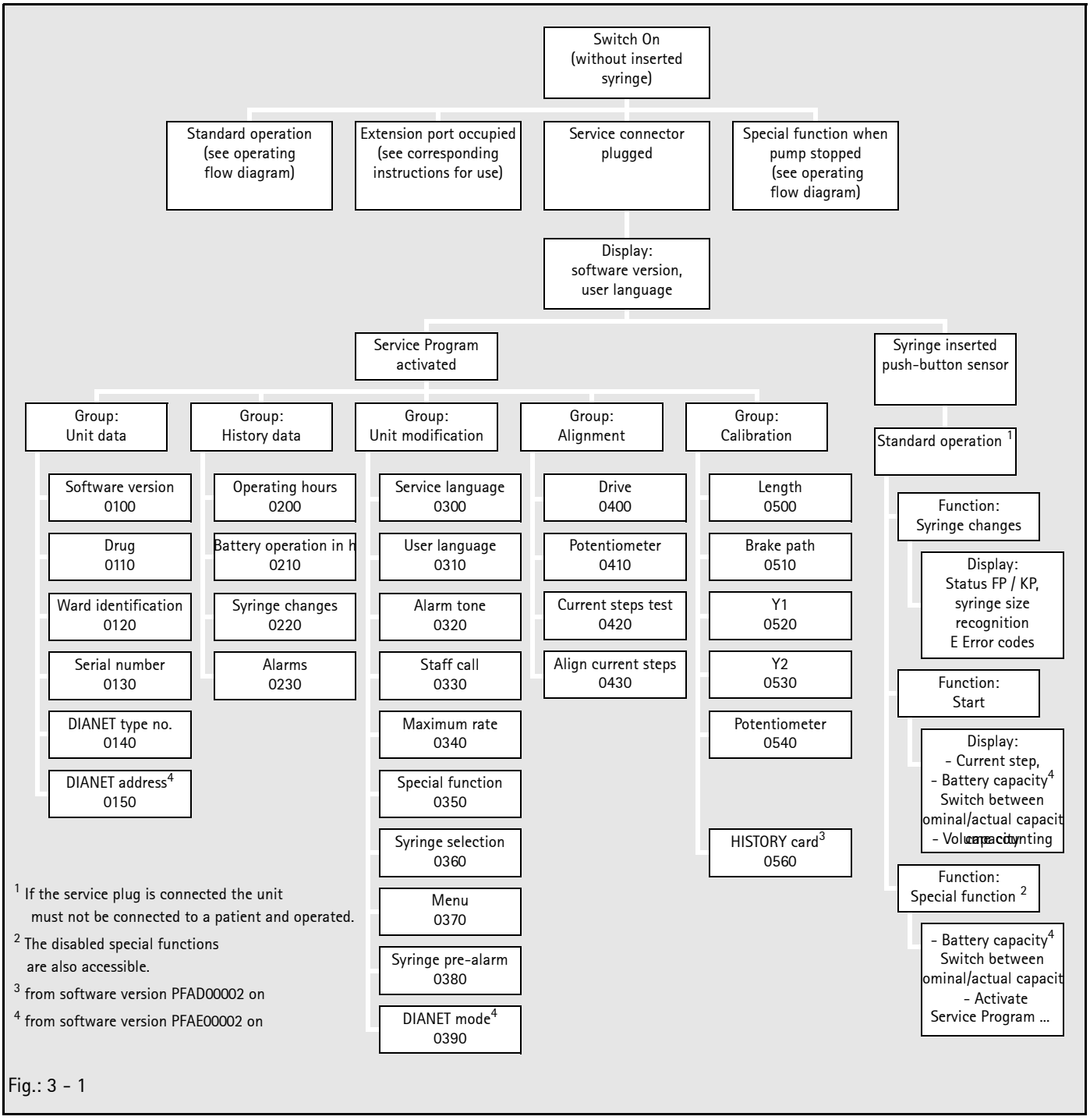


Fig.: 3 - 1

Start / Quit the Service Program

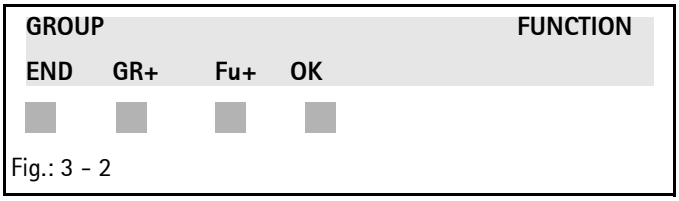


Fig.: 3 - 2

Activate the Service Program

1. Plug the service connector on the staff call socket (do not insert a syringe).

Note

If the unit is switched on with a syringe inserted or if the syringe is inserted after having switched on the unit the Service Program can be selected via the SM key.

2. Switch on unit. - ** - appears in the display if the service connector is plugged.
3. Start the Service Program with softkey ON. The red alarm LED flashes.

FUNCTION

END	Jumps to the initial function
GR+	Selects group
FU+	Selects function in the activated group
OK	Activates the selected function or if necessary skips to the sub-functions with NEXT

Quit the Service Program

1. Press END in the main menu. - A data storage query is activated: "Save changes? Yes / No".
   Y / N terminates the Service Program.
   Press END to jump to the last function.
2. Switch off unit and disconnect the service connector.

Note

Disconnect the unit from mains for at least 30 seconds after termination of the Service Program (memory is deleted). Then the unit can be switched on again.

Additional Functions with Plugged Service Connector

Information Software Version and User Languages

1. Plug service connector on staff call socket at the rear of the unit and keep the ON/OFF button pressed (max. 15 s).
2. The software version and user languages are displayed in the LCD-display.
3. The unit is switched on when the ON/OFF button is released.
4. ** appears in the LCD-display if the service connector is plugged.

The following conditions are active:

- The operating alarms are muted.
- All special functions are accessible (including the disabled).
- The special functions are slightly modified. (Example: SM battery capacity has keys for 0 min/5 min presetting).

Further Available Information

1. Execute steps 1. to 4. as described above.
2. Insert syringe (push-button sensor must be initiated).

Function Syringe Change (pull syringe holder):

- Display of the program status of the function processor 535 and the control microprocessor hc11.
- Display of the syringe size recognition for each microprocessor.
- Display of the E error codes for the drive unit (see „Drive Error Conditions" ➨ pg. 2 - 10).

Function Start (press Start key):

- Display of the active current step.
- Display volume counter with rate display.

Unit Data

Software Version **Function 0100**

1. Select sub-functions with NEXT.
2. The current software version is displayed in the LCD-display:
   - Basic unit version
   - User languages
   - Service Program version
   - Service languages
   - Memory cards: Sub-function only available if cards have installed program (e.g. PCA).
3. Return to the initial function with END.

Drug Name **Function 0110**

Memory for maximum 10 drugs and 20 characters per name.

1. Display the stored drug names with the NEXT key.
2. Delete displayed entry with CLR.
3. Press YES to modify a drug name:
   Move cursor to character with NEXT.
   Select new character from line 1 with << or >>.
4. Repeat the procedure for each character.
5. Return to the initial function with END.

Ward Identification **Function 0120**

Enter and display of a ward specific unit identification. Permanent display if the unit is connected to mains and switched off.

1. Delete displayed entry with CLR. Press YES to enter modifications:
   Move cursor to character with NEXT.
   Select new character from line 3 with << or >>.
2. Repeat the procedure for each character.
3. Return to the initial function with END.

Serial Number **Function 0130**

The displayed serial number must correspond with the number on the unit type plate, as this number is used in CC mode.

1. YES activates the entry mode.
2. Enter via numeric keyboard.
3. YES stores the changed or new number.
4. Return to the main menu with END.

DIANET Type Number **Function 0140**

The displayed DIANET number must correspond with the Dt number on the unit type plate, as this number is used in CC mode.

1. YES activates the entry mode.
2. Enter via numeric keyboard.
3. YES stores the changed or new number.
4. Return to the initial function with END.

DIANET Address **Function 0150[6]**

The DIANET address is only required for the PCA module.

1. YES activates the entry mode.
2. Enter via numeric keyboard.
3. YES stores the changed or new number.
4. Return to the initial function with END.

[1] from software version PFAC00002 on
[2] from software version PFAD00001 on
[3] from software version PFAD00002 on
[4] from software version PFAD00003 on
[5] not available from software version PFAE00002 on
[6] from software version PFAE00002 on

History Data

Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Code	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**

Example for Alarm "Syringe empty"

0	Battery empty (battery alarm)
1	Syringe empty
2	Occlusion alarm
3	Expired standby time (2 min)
4	Expired standby time (special function)
5	CC alarm (interface)
6	Volume end (not in CC mode). In CC mode the pre-selected volume is processed. Volume end is not an alarm in CC mode.
7	Time-out (not in CC mode). Time pre-selection not in CC mode.
8	Syringe alarm
9 to 14	free
15	Operating alarm

Fig.: 3 - 3

Operating Hour Counter **Function 0200**

1. OK activates the display.
2. Return to the initial function with END.

Battery Operating Hours **Function 0210**

1. OK activates the display.
2. Return to the initial function with END.

Syringe Changes **Function 0220**

The number of performed syringe changes is displayed. Only those syringe changes are counted, which were correctly detected by the claw.

1. OK activates the number display.
2. Return to the initial function with END.

Operating Alarms **Function 0230**

The last 10 operating alarms can be recalled.

These are displayed as 16 bit binary codes, and each bit position can be set from 0 to 1.

1. OK activates the alarm display.
2. Display operating alarms -01 to -10 with the (+) and (-) key.
3. Delete the operating alarms with CLR.
4. Return to the initial function with END.

From software PFAD00003 on unit alarms are also displayed, e.g. GA=xxx yyy (xxx = processor 535, yyy = processor hc11).

With CLR all unit alarms are deleted.

Unit Modifications

Service Language **Function 0300**

English or German can be selected.

1. OK activates the function.
2. Select language with NEXT.
3. Acknowledge with YES.
4. Return to the initial function with END.

User Language **Function 0310**

Four user languages per language group are available (depending on software).

1. OK activates the function.
2. Select language with NEXT. The language no. and software version are displayed.
3. Acknowledge with YES.
4. Return to the initial function with END.

Alarm Tone **Function 0320**

The following different alarm modes can be selected:

- Single stage: continuous tone (65 dBA).
- Suppression of all audible alarms for the first 10 minutes. Activation is only permissible if the staff call is connected. (Unit must be labelled with a sticker according to drawing no. M00710 00 00 F04).

1. OK activates the function.
2. Select alarm tone with NEXT.
3. Acknowledge with YES.
4. Return to the initial function with END.

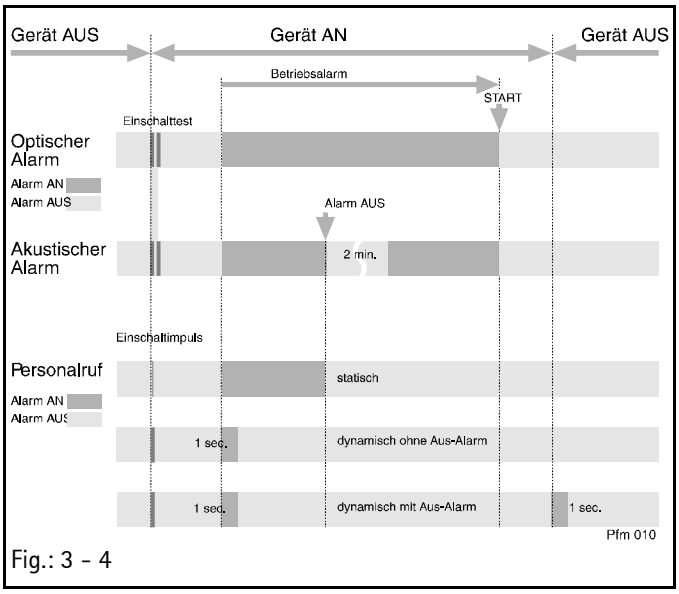


Fig.: 3 - 4

Staff Call **Function 0330**

The following different staff call modes can be selected:

- Static without OFF Alarm
- Dynamic without OFF Alarm
- Dynamic with OFF Alarm
- Starting impulse On/Off[4]
- Staff call at pre-alarm On/Off[6]

1. OK activates the function.
2. Select staff call type with NEXT.
3. Acknowledge with YES.
4. Return to the initial function with END.

Maximum Rate **Function 0340**

The standard setting is 200 ml/h. The value can be changed between 0.1 and 999.9 ml/h.

1. OK activates the function.
2. Enter the maximum rate via keyboard.
3. Acknowledge with YES.
4. Return to the initial function with END.

[1] from software version PFAC00002 on
[2] from software version PFAD00001 on
[3] from software version PFAD00002 on
[4] from software version PFAD00003 on
[5] not available from software version PFAE00002 on
[6] from software version PFAE00002 on

Special Functions **Function 0350**

Special functions can be activated in the Service Program, which are then available on the user interface. Deactivated special functions are not displayed on the user interface.

The SM softkey will not be displayed in standard operation in the LCD-display, if all special functions are deactivated. - Special functions to be selected:

- Dose calculation[2]
- Bolus function
- Standby function
- Drug selection
- CC mode
- Contrast

1. OK activates the function.
2. Select special functions with NEXT.
3. Enable / disable respective functions with YES/NO.
4. Return to the initial function with END.

Syringe Selection **Function 0360**

The available syringe types can be enabled/disabled in the Service Program. A disabled syringe type is not displayed on the user interface. Available syringe types:

- 10 ml Omnifix[1]
- 20 ml Original Perfusor Syringe (OPS)
- 50 ml OPS

Additional syringe types upon request. The syringes used must be approved by an authorized test body.

1. OK activates the function.
2. Select syringe type with NEXT.
3. Enable / disable respective functions with YES/NO.
4. Return to the initial function with END.

[1] Apply syringe only with 10 ml adapter or disable in the Service Program.
[2] from software version PFAC00002 on

Menu **Function 0370**[1]

The availability of menus on the user interface can be set:

- Double rate entry
- Online rate entry
- Purge key
- Interval bolus

1. OK activates the function.
2. Select menu with NEXT.
3. Enable / disable respective menu with YES / NO.
4. Return to the initial function with END.

Syringe Pre-Alarm Time **Function 0380**[1]

The syringe pre-alarm time (3 to 30 minutes) can be set:

1. OK activates the function.
2. Enter the syringe pre-alarm time via the numeric keyboard.
3. Acknowledge syringe pre-alarm time with YES.
4. Return to the initial function with END.

DIANET-Mode Display **Function 0390**[6]

The time of persistence (0 to -255 seconds) of the DIANET mode display can be set:

1. OK activates the function.
2. Enter the time of persistence via the numeric keyboard.
3. Acknowledge the time of persistence with YES.
4. Return to the initial function with END.

[1] from software version PFAC00002 on
[2] from software version PFAD00001 on
[3] from software version PFAD00002 on
[4] from software version PFAD00003 on
[5] not available from software version PFAE00002 on
[6] from software version PFAE00002 on

Alignment

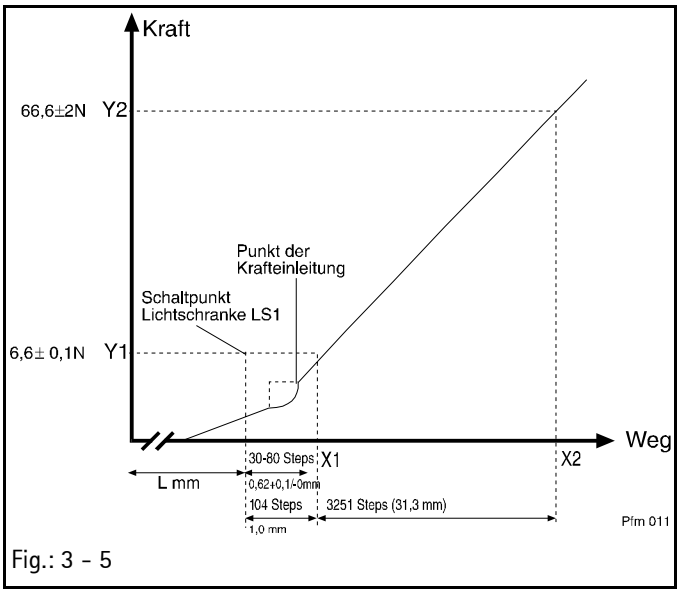


Fig.: 3 - 5

Test Equipment **Ord. No.**

Drive alignment gauge. 0770 1535

Drive **Function 0400**

The drive is calibrated with the alignment gauge. The following values are automatically determined:

- Length of the drive in motor steps L.
- Brake path in motor steps (B).
- Alignment of pressure sensor Y1, Y2.

Do not interrupt the automatic alignment as otherwise alignment is to be repeated.

1. OK activates the function.
2. Repeated OK starts search for the zero position.
3. Insert alignment gauge.
4. OK starts alignment.
5. Length, force Y1, force Y2 and brake path are automatically determined. Values are displayed in the LCD-display.
6. Press YES to save the alignment values, if the values are within the limits of the set values.
   Length L: 1030-1400,
   Force Y1: 29000 -33000,
   Force Yd: 1050-3000,
   Brake path B: 30-80
7. Return to the initial function with END.

Alignment of force Y1

The drive is pushed forward by 1.0 mm from the reference point. Hence the syringe alignment gauge is compressed by 0.4 mm. The syringe gauge is calibrated to a force of 6.6 Newton in this working step. Switching point LS1 + 104 motor steps ("low force = 6.6 – 0.1 Newton").

Alignment of force Y2

The drive is pushed forward by 32.3 mm from the reference point. Hence the syringe alignment gauge is compressed by 32.7 mm. The syringe gauge is calibrated to a force of 66.6 Newton in this working step. Switching point LS1 + 3355 step ("high force: = 66.6 + 2 Newton"). After alignment of the force measurement the drive is advanced with positioning speed to the rear end position.

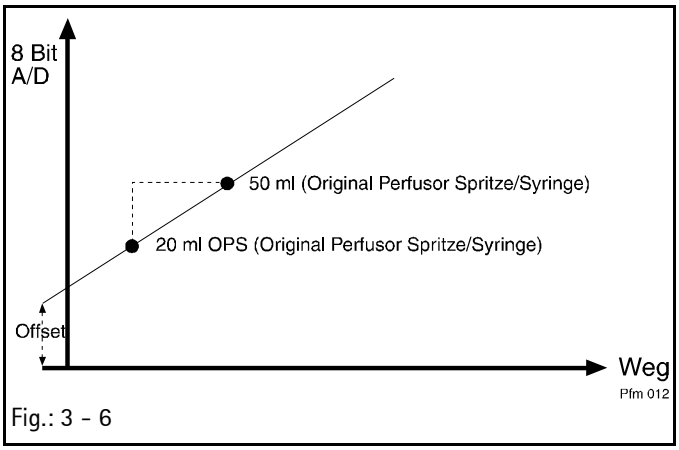


Fig.: 3 - 6

Alignment of brake path B

The drive runs from the rear end position to the switching point of the push-button sensor. From here the point of force initiation is detected. This point is at a distance of <30 to >80 motor steps. Brake path = switching point LS1 to force initiation. Brake path = <30 to >80 motor steps.

Alignment of drive length L

The drive length L is the length of the syringe gauge (122.0 mm) + path from the rear end position to the light barrier LS1 (push-button sensor). This is equivalent to: Drive length = 12688 motor steps + L motor steps from rear end position to LS1.

Potentiometer **Function 0410**

The alignment is necessary to recognize the diameter of the inserted syringe and thus to ensure a safe detection of the syringe volume. The value range of the 10, 20, and 50 ml syringes is determined. The calculation is based on the 20 and 50 ml OPS syringes.

1. OK activates the function.
2. Insert 20 ml potentiometer gauge and secure with holder.
3. Acknowledge the result with OK and switch to 50 ml syringe.
4. Insert 50 ml gauge and secure with holder.
5. Acknowledge the measurement value with OK and completely open the holder.
6. Acknowledge the measurement value with OK.
7. Save alignment with YES and return to the main menu.
8. Return to the initial function with END.

Check in standard operation with the max. 50 ml potentiometer gauge. The diameter must be recognized.

Test Current Steps **Function 0420**

The forward feed of the drive motor has 4 current steps. Thus it is determined how much force can be applied on the syringe. This function is a redundant pressure limitation. Use a current step gauge or a manometer with a 50 ml OPS syringe to perform test (see „Technical Safety Check TSC" ➨ pg. 7 - 1).

1. OK activates the function.
2. The zero position is searched.
3. Insert the current step gauge or 50 ml syringe and secure with syringe holder.
4. Start with OK.
5. The current step 0 is checked.

CAUTION

Current step 3 must not be tested as the system may be damaged by overload.

6. Activate and check current steps 1 and 2 with NEXT.
7. The zero position is searched with END and the system is switched to the initial function. Do not press END during search process!

WARNING

GAUGE MUST NOT BE UNDER TENSION WHEN IT IS REMOVED - DANGER OF INJURY!

8. Remove alignment gauge.
9. STOP to interrupt.

Alignment of Current Steps **Function 0430**

This function is only for the unit test and must not be applied in the Service Program.

Calibration

The calibration group is only for information. If these parameters are changed, a new calibration must be performed with calibrated test equipment.

Length (Drive) **Function 0500**

1. OK activates the function.
2. The value could be changed with the entry keyboard.
3. Acknowledge the measurement value with YES.
4. Return to the main menu with END.

Function	Tolerance Range	
Length L	min. 1030	max. 1400
Force Y1	min. 29000	max. 33000
Force Yd	min. 1050	max. 3000
Brake path B	min. 30	max. 80

Table 3 - 1 Limit values

Brake Path **Function 0510**

1. OK activates the function.
2. The value could be changed with the entry keyboard.
3. Acknowledge the measurement value with YES.
4. Return to the main menu with END.

Force Y1 **Function 0520**

1. OK activates the function.
2. The value could be changed with the entry keyboard.
3. Acknowledge the measurement value with YES.
4. Return to the main menu with END.

Force Y2 **Function 0530**

1. OK activates the function.
2. The value could be changed with the entry keyboard.
3. Acknowledge the measurement value with YES.
4. Return to the main menu with END.

Potentiometer **Function 0540**

Calibration values for syringe recognition.

1. OK activates the function.
2. Switch between control and function microprocessor with NEXT.
3. Return to the main menu with END.

History Card **Function 0560**[1]

For installation of the History card.

1. OK activates the function.
2. Activate the History card with CLR. The protocol on the card is directly deleted when the CLR key is pressed and the current software version and the serial no. is entered.
3. Return to the initial function with END.

[1] from software PFAD 00002 on

For your notes:

Unit Elements 4

4.1 Mains Fuses

Designation	Ord. No.
Fuse T 0.315 A for 230 / 240 V (10 pcs.)	3477 0534
Fuse T 0.63 A for 110 / 120 V (10 pcs.)	3477 0267

Note

Only use recommended fuses.

Exchange

1. Press snap-in pins in direction of the arrows (fuse holder recessed plug) and pull out.
2. Exchange fuses.
3. Close fuse holder. Only use recommended fuses.

Check

The LED mains control lamp must be on in mains mode.

4.2 Battery

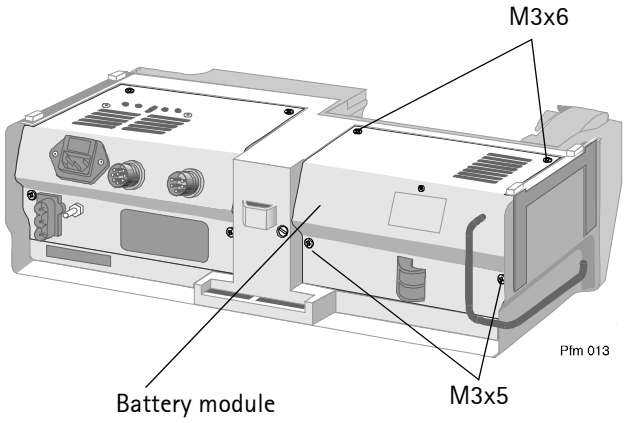


Fig.: 4 - 1

Designation	Ord. No.
1.8 Ah battery (hightemp)	3450 6357

Exchange

If <2h is displayed despite fully charged, an exchange of the battery is recommended.

1. Loosen 2 screws with serrated lock washers on the rear wall and 2 screws with serrated lock washers on the bottom side.
2. Pull out battery module.
3. Pull connection cable off the controller board and disconnect cable ties.
4. Exchange battery.
5. Assemble new battery with cable ties. The battery connecting wires must point to the unit top side.
6. Acknowledge the continuous tone by pressing the ON/OFF key until short tones are audible.
7. Insert battery module.
8. Charge battery.

Note

Defective batteries must be orderly disposed of, e.g. send back to B. Braun Melsungen AG, Wareneingang.

Check

After 16 hours charge nearly the total running time must be displayed on the LCD-display.

4.3 Unit Feet

Designation	Ord. No.
Rubber feet (set of 4 pcs.)	3477 3983
Unit feet left, complete	3450 7671
Unit feet right, complete	3450 7680

Exchange

1. Remove screws and exchange complete plastic parts.

Note

The rubber feet can also be exchanged separately. They can be removed to the back if the unit feet were dismounted.

4.4 Syringe Adapter

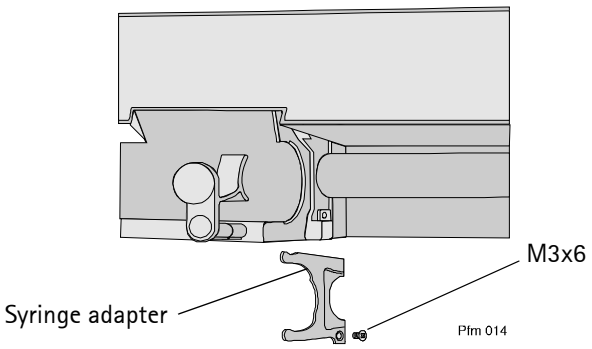


Fig.: 4 - 2

Designation **Ord. No.**

Adapter for 20 ml to 50 ml syringes. 3450 7540

Adapter for 10 ml syringe 3450 7558

Exchange

The drive unit must be in the end position for disassembly.

1. Remove screw. Remove syringe adapter and exchange. Safety lock screw with Loctite 242 medium.

Note

When using the 50 ml adapter all 10 ml syringes must be disabled. Only enable 10 ml syringes when the 10 ml adapter is assembled, disable the other syringe sizes.

4.5 Syringe Holder

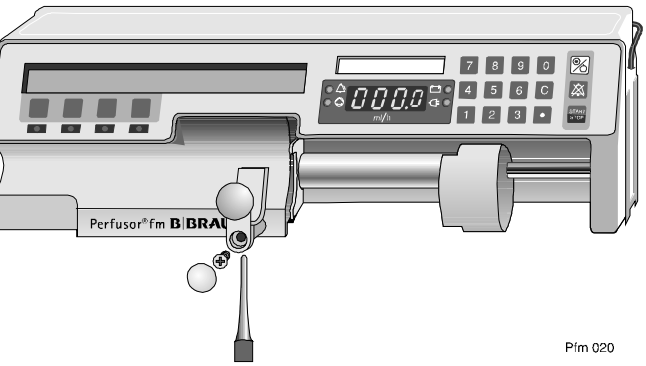


Fig.: 4 - 3

Designation **Ord. No.**

Syringe holder without blind plug 3477 3843

Exchange

1. Pierce through the tamper-proof cap and remove.
2. Position the holder axis through the hole in the bottom of the unit with a pin punch.
3. Remove screw and exchange holder.
4. Assemble new screw (not the old one) and safety lock with Loctite 242 medium. Replace tamper-proof cap.
5. Perform potentiometer calibration.

Check

Calibrate syringe recognition. Perform alignment / potentiometer in the Service Program.

4.6 Mains Transformer

Designation	Ord. No.
Mains transformer 200-240 V without wiring	3450 7450
Connector label E (200 - 240 V)	on request
Mains transformer 100-120 V without wiring	3450 8023
Connector label E (100 -120 V)	on request

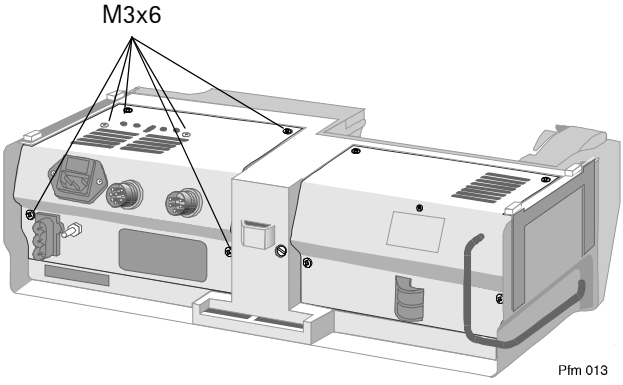


Fig.: 4 - 4

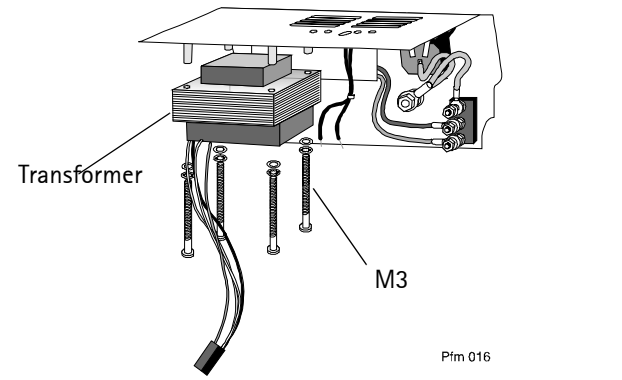


Fig.: 4 - 5

Exchange

1. Loosen screws and remove screws with plain washer and toothed washer on the rear wall and the unit bottom side.
2. Swing out battery module.
3. Pull connection cable off the analog board and the controller board.
4. Loosen screws on the mains transformer.
5. Unsolder connection cable on the transformer to the mains socket (primary side) and the analog board (secondary side).
6. Replace transformer.
7. Push new shrink tube over cable (primary side: size 2, secondary side: size 1).
8. Solder the connection cables and insulate with shrink tube.
9. Assembly is done in reverse order. Safety lock screws of transformer with Loctite.

Check

Check electrical safety (see „Checks after Repair" ➨ pg. 5 - 1).

4.7 Housing Cover

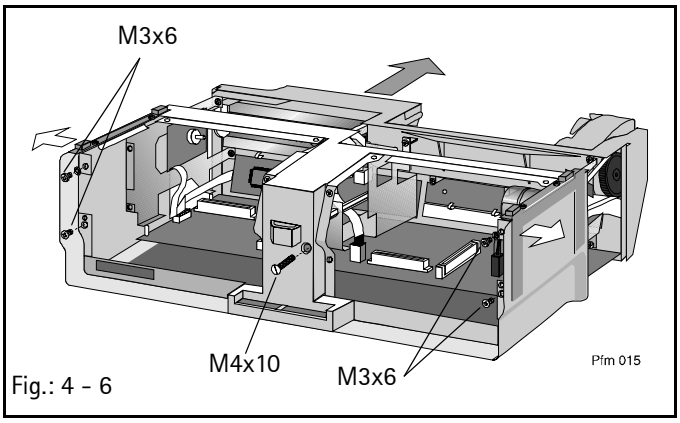


Fig.: 4 - 6

Designation	Ord. No.
Housing cover with labelling and unit feet	
German	3450 7426
French	3450 4460
Dutch	3450 7779
Italian	3450 7787
English	3450 7795
Spanish	3450 7809
Danish	3450 7817
Norwegian	3450 7829
Swedish	3450 7833
Finnish	3450 7841
Portuguese	3450 7850
Czech	3450 7868
Polish	3450 7876
Castellano	3450 7884
Turkish	3450 7892
Quick reference guide	3452 1291

Exchange

1. Remove battery (see „Battery" ➨ pg. 4 - 2).
2. Remove mains transformer (see „Mains Transformer" ➨ pg. 4 - 4).
3. Pull out analog board.
4. Pierce seal and tamper proof cap and remove.
5. Remove screw with toothed washer from tension rod.
6. Remove screws with toothed washers on the unit back.
7. Exchange housing cover.
8. Assembly is done in reverse order.
9. Modify cover of optical interface.

Check

- Check distance of operating unit (see „Distance of Operating Unit" ➨ pg. 8 - 2).
- Check function and electrical safety (see „Checks after Repair" ➨ pg. 5 - 1).

4.8 Unit Holder

Designation **Ord. No.**

Unit holder complete incl. twist-snapper. 3450 7655

Exchange

1. Remove battery module (see „Battery" ➨ pg. 4 - 2).
2. Remove screws on handle with plain washers.
3. Replace carrying handle or twist-snapper on the inside of the battery module.
4. Assembly is done in reverse order.

4.9 Hinge Hooks

Designation **Ord. No.**

Hinge hooks 3477 3924

Exchange

1. Remove battery module (see „Battery" ➨ pg. 4 - 2).
2. Remove screws.
3. Replace hinge hooks.
4. Assembly is done in reverse order.

4.10 Assembly Plate of Battery Module

Designation **Ord. No.**

Assembly plate battery module. 3450 7477

Exchange

1. Remove battery (see „Battery" ➨ pg. 4 - 2).
2. Remove hinge hooks (see „Hinge Hooks" ➨ pg. 4 - 6).
3. Exchange assembly plate of battery module.
4. Assembly is done in reverse order.

4.11 Potential Equalization Bolt

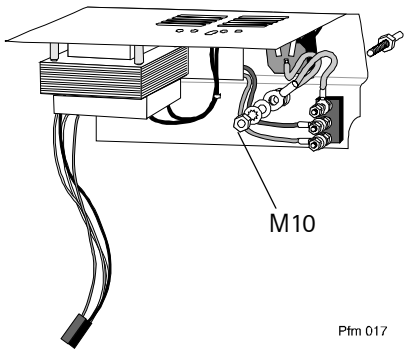


Fig.: 4 - 7

Designation **Ord. No.**

Potential equalization bolt 3477 0550

Exchange

1. Remove power supply module (see „Mains Transformer" ➨ pg. 4 - 4).
2. Remove nut with toothed and plain washers.
3. Disconnect earthing cable.
4. Remove nut with toothed washer.
5. Exchange potential equalization bolt.
6. Assembly is done in reverse order. Note position of the plain washers.

Check

Check electrical safety (see „Checks after Repair" ➨ pg. 5 - 1).

4.12 Recessed Plug

Designation **Ord. No.**

Recessed plug 3450 5644

Exchange

1. Dismount power supply module (see „Mains Transformer" ➨ pg. 4 - 4).
2. Remove shrink tube from the cable terminals.
3. Unsolder the connection cables (L, N, SL).
4. Loosen screws and remove recessed plug.
5. Push new shrink tube over cable.
6. Solder the connection cables and insulate with shrink tube. Make sure that the terminal assignment is correct.
7. Assembly is done in reverse order. Insert mains fuse F1 and F2.

Check

Check electrical safety (see „Checks after Repair" ➨ pg. 5 - 1).

4.13 fm Recessed Plug

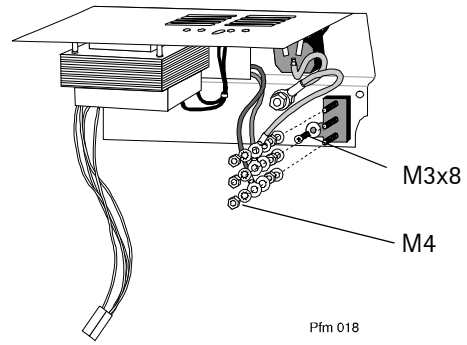


Fig.: 4 - 8

Designation **Ord. No.**

fm recessed plug (3 pin) 3477 3177

Exchange

1. Dismount power supply module (see „Mains Transformer" ➨ pg. 4 - 4).
2. Remove 3 nuts.
3. Remove toothed washer, plain washer and cable connector.
4. Remove screw with plain washer.
5. Exchange fm recessed plug.
6. Assembly is done in reverse order. Make sure that the cable connections are correct. The recessed plug must be slightly moveable after assembly for correct locking in the fm system.

Check

Check electrical safety (see „Checks after Repair" ➨ pg. 5 - 1).

A functional check is only possible with an fm system.

4.14 Rear Panel Board

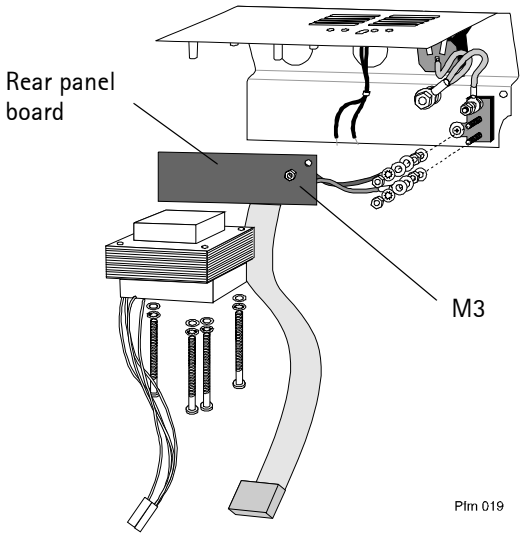


Fig.: 4 - 9

Designation **Ord. No.**

Rear panel board 3450 7582

Exchange

1. Dismount mains transformer (see „Mains Transformer" ➨ pg. 4 - 4).
2. Remove nut with toothed washer.
3. Disconnect cable connector (rd/bl) on fm recessed plug (see „fm Recessed Plug" ➨ pg. 4 - 8).
4. Loosen nut on staff call- and 12 V recessed plug.
5. Exchange rear panel board.
6. Assembly is done in reverse order. Bend locking hook in connector P1 back.

Check

Check electrical safety (see „Checks after Repair" ➨ pg. 5 - 1).

4.15 Assembly Plate of Power Supply Module

Designation **Ord. No.**

Assembly plate power supply module 3450 7442

Exchange

1. Dismount mains transformer (see „Mains Transformer" ➨ pg. 4 - 4).
2. Dismount potential equalization bolt (see „Potential Equalization Bolt" ➨ pg. 4 - 7).
3. Remove rear panel board (see „Rear Panel Board" ➨ pg. 4 - 8).
4. Exchange assembly plate of power supply module.
5. Assembly is done in reverse order.

Check

Check electrical safety (see „Checks after Repair" ➨ pg. 5 - 1).

4.16 Left Assembly Plate A

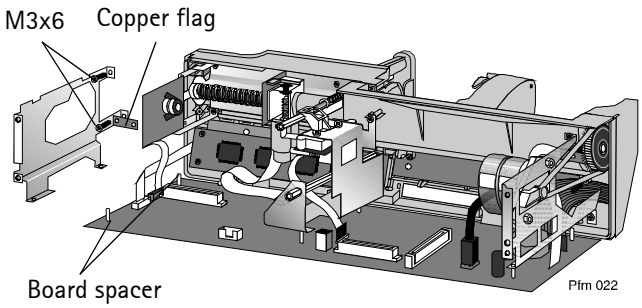


Fig.: 4 - 10

Designation **Ord. No.**

Left assembly plate (web plate) 3450 7647

Exchange

1. Dismount housing cover (see „Housing Cover" ➨ pg. 4 - 5).
2. Loosen screws and board spacer on assembly plate.
3. Remove copper flag.
4. Exchange assembly plate.
5. Assembly is done in reverse order. Do not damage copper flag. Tighten screws carefully.

Check

Check function and electrical safety (see „Checks after Repair" ➨ pg. 5 - 1).

4.17 Stepper Motor

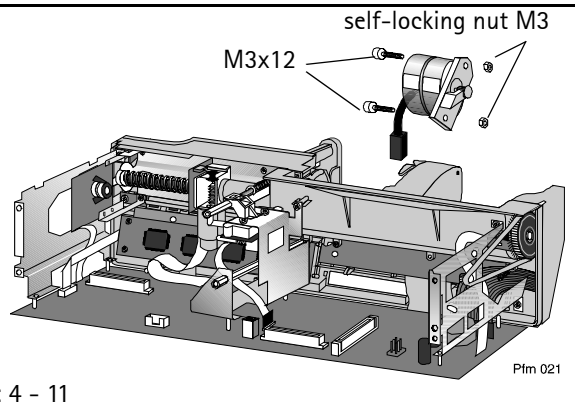


Fig.: 4 - 11

Designation **Ord. No.**

Stepper motor. 3450 7566

Exchange

Tools: Allen key 2.5 mm, socket spanner 5.5 mm, setting gauge for toothed belt tension, syringe calibration gauge.

1. Remove housing cover (see „Housing Cover" ➨ pg. 4 - 5).
2. Disconnect connection cable of motor controller board from controller board.
3. Remove screws and nuts.
4. Exchange stepper motor and locking bow for toothed belt.
5. Assembly is done in reverse order.

Check

Adjust belt tension with setting gauge. Then align in Service Program / test current steps.

Check electrical safety (see „Checks after Repair" ➨ pg. 5 - 1).

4.18 Right Assembly Plate B

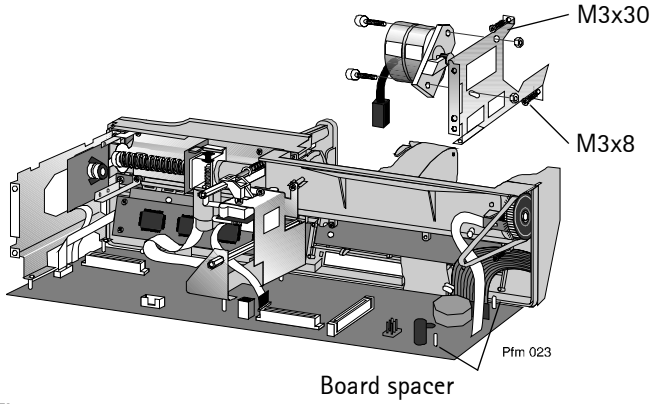


Fig.: 4 - 12

Designation **Ord. No.**

Right assembly plate (motor support) 3450 7620

Exchange

1. Dismount housing cover (see „Housing Cover" ➨ pg. 4 - 5).
2. Dismount stepper motor (see „Stepper Motor" ➨ pg. 4 - 10)
3. Loosen screws and board spacer on assembly plate.
4. Exchange assembly plate.
5. Assembly is done in reverse order.

Check

Alignment / test current steps in Service Program.

Check function and electrical safety (see „Checks after Repair" ➨ pg. 5 - 1).

4.19 Middle Assembly Plate C

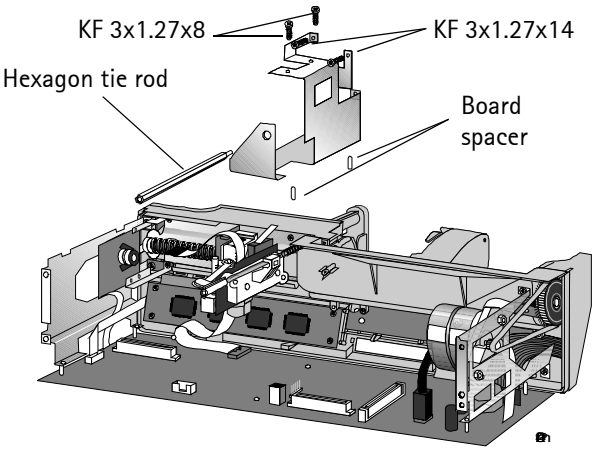


Fig.: 4 - 13

Designation **Ord. No.**

Middle assembly plate (middle plate) 3450 7639

Exchange

1. Dismount housing cover (see „Housing Cover" ➨ pg. 4 - 5).
2. Disconnect connection cable of potentiometer board from controller board.
3. Loosen spacer of middle assembly plate from controller board.
4. Loosen spacer of middle assembly plate from potentiometer board.
5. Turn board aside.
6. Dismount hexagon tie rod, loosen screws on middle assembly plate.
7. Remove both spacers from middle assembly plate and fit on new plate.
8. Exchange middle assembly plate.
9. Assembly is done in reverse order. Take care not to damage the microswitch lever.
10. Safety lock tie rod with Loctite.

Check

Calibrate syringe recognition. Perform alignment / potentiometer in the Service Program.

Check function and electrical safety (see „Checks after Repair" ➨ pg. 5 - 1).

4.20 Syringe Recognition

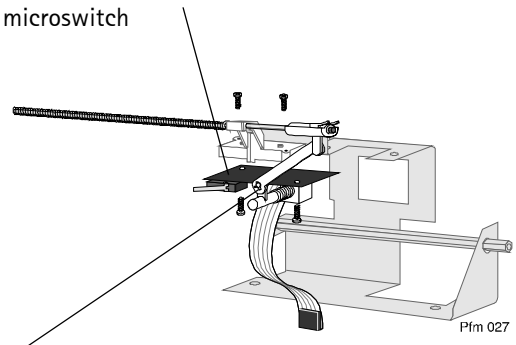


Fig.: 4 - 14

Designation	Ord. No.
Potentiometer board	3450 7507
Microswitch	3450 7523
Potentiometer 2x10 kOhm	3450 7515
Reversing lever for potentiometer	3450 7604

Exchange

Tools: Potentiometer gauges 20 and 50 ml.

1. Remove cover (see „Housing Cover" ➨ pg. 4 - 5).
2. Pull off connector from the controller board.
3. Remove reversing lever.

Note

Replace lock washer or self-locking nut.

4. Loosen 2 screws (3x1.27x8) of potentiometer board on middle plate. Turn plastic socket with board aside.
5. Loosen 2 screws (3x1.27x8) of board on plastic socket.
6. Exchange board (or unsolder microswitch or potentiometer) and replace.
7. Assembly is done in reverse order.

Check

Alignment / potentiometer in Service Program.

Check electrical safety (see „Checks after Repair" ➨ pg. 5 - 1).

4.21 Recess

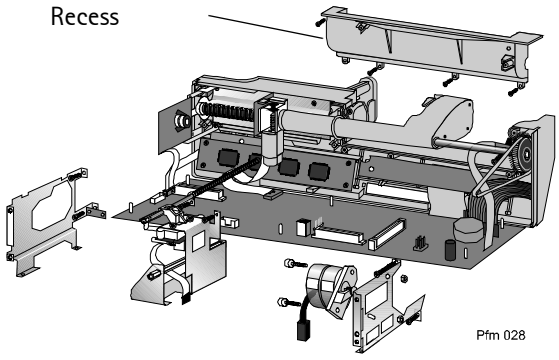


Fig.: 4 - 15

Designation **Ord. No.**

Recess for syringe 3450 7590

Exchange

1. Remove housing cover (see „Housing Cover" ➨ pg. 4 - 5).
2. Dismount stepper motor (see „Stepper Motor" ➨ pg. 4 - 10).
3. Dismount left assembly plate (see „Left Assembly Plate A" ➨ pg. 4 - 9).
4. Dismount drive unit (see „Drive Unit" ➨ pg. 4 - 14).

Check

Alignment / potentiometer in Service Program.

Check electrical safety (see „Checks after Repair" ➨ pg. 5 - 1).

4.22 Drive Unit

Designation	Ord. No.
Drive unit complete with claw motor and seal ring, without stepper motor	3450 7434
Claw motor, cpl.	3450 7922
Counter reverse washer (bronze)	3477 4033
Spacer ring	3450 7914
Needle bearing	3450 7906
Counter washer	3477 4025
Locking washer 3.2 mm (20 pcs.)	3477 4017
Recess for syringe	3450 7590

Note

Only exchange complete drive unit.

Note

Oil spindle slightly with Molykote Gleitmo 805 (standard grease) if there is a running noise from the drive.

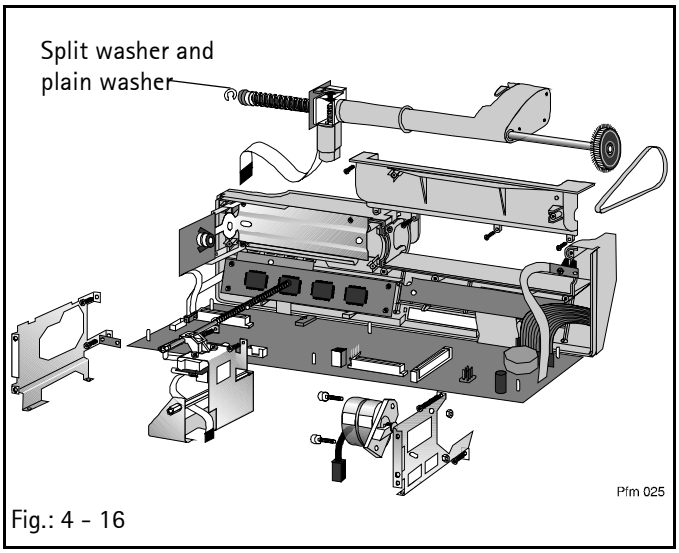


Fig.: 4 - 16

Exchange

1. Remove housing cover (see „Housing Cover" ➨ pg. 4 - 5).
2. Pull connector cable off the controller board.
3. Dismount stepper motor (see „Stepper Motor" ➨ pg. 4 - 10).
4. Dismount middle assembly plate (see „Middle Assembly Plate C" ➨ pg. 4 - 11).
5. Remove plug connector from controller board.
6. Dismount right assembly plate (see „Right Assembly Plate B" ➨ pg. 4 - 10).
7. Set drive to middle position. If necessary turn the toothed belt by hand.
8. Dismount recess (see „Recess" ➨ pg. 4 - 13).

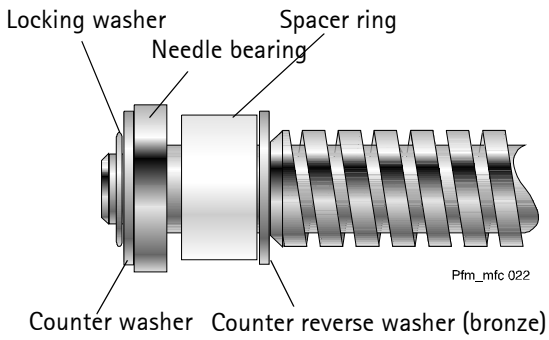


Fig.: 4 - 17

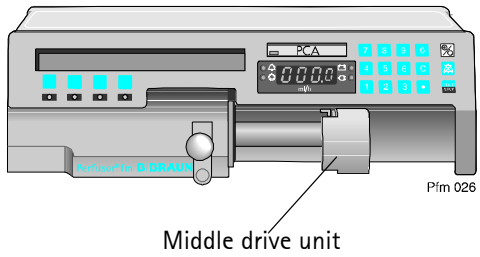


Fig.: 4 - 18

9. Remove split washer and plain washer from drive axle.
10. Pull counter reverse washer (bronze) off the axle.

11. Turn drive unit to the inside and tilt out of the fastening under the claw motor.

Note

Do not lose the plastic sleeve and bearing!

12. Set new drive to middle position and assemble bronze washer.
13. Insert drive from the left and press slide into the guide rail.
14. Push plain washer and split washer on the drive axle.
15. Mount radial fastening on claw motor.
16. Lock packing washer and slide bearing, place toothed belt on toothed wheel and fit plug connectors.
17. Assemble the remaining parts in reverse order.
18. Adjust toothed belt tension with gauge.

Check

The drive is calibrated by the manufacturer. The unit must be calibrated after exchange. Call up Calibration / Drive in Service Program and delete old calibration data prior to alignment. Completely calibrate the unit.

Functional check (see „Checks after Repair" ➡ pg. 5 - 1).

4.23 LCD Module

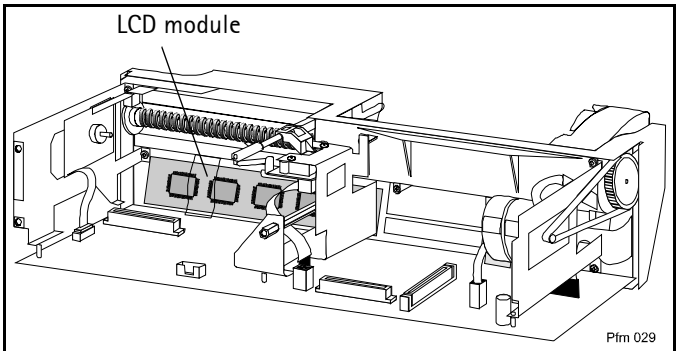


Fig.: 4 - 19

Designation	Ord. No.
LCD module board	3450 7418

Exchange

1. Remove cover (see „Housing Cover" ➨ pg. 4 - 5).
2. Remove locking clamp from LCD module.
3. Pull connector off the LCD module and controller board.
4. Remove assembly screws and pull out LCD module out to the side.
5. Assembly is done in reverse order.

Check

Self-test after switch-on. Pixels in display.

4.24 Guide Rail

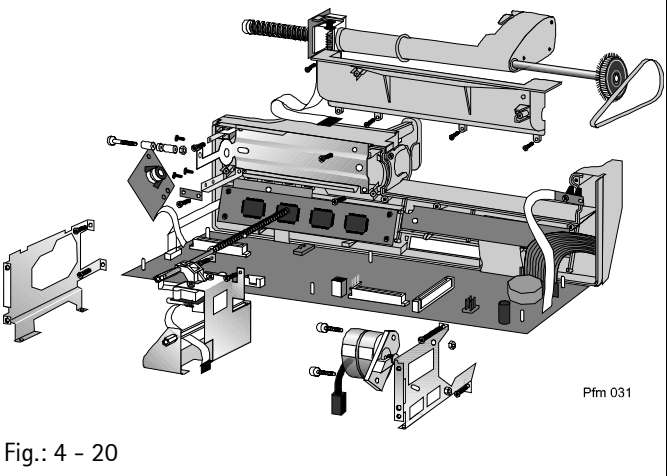


Fig.: 4 - 20

Designation	Ord. No.
Guide rail	3917 5880

Exchange

1. Dismount cover (see „Housing Cover" ➨ pg. 4 - 5).
2. Dismount drive unit and left assembly plate.
3. Remove pressure sensor board carefully when snap-in hook and screw were loosened.
4. Remove 4 screws (M 3x6) of the guide rail.
5. Remove copper flag.
6. Exchange guide rail. Take care not to damage the copper flag.
7. Assembly is done in reverse order. Pay attention to correct position of the washers.
8. Adjust toothed belt tension with setting gauge.

Check

Test current steps in Service Program.

Check function (see „Checks after Repair" ➨ pg. 5 - 1).

4.25 Operating Unit

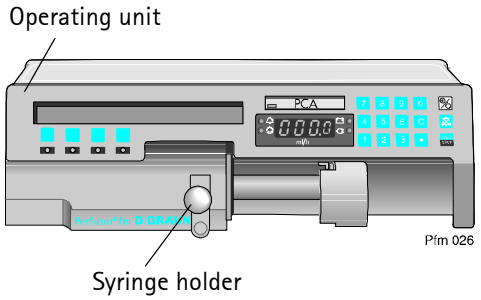


Fig.: 4 - 21

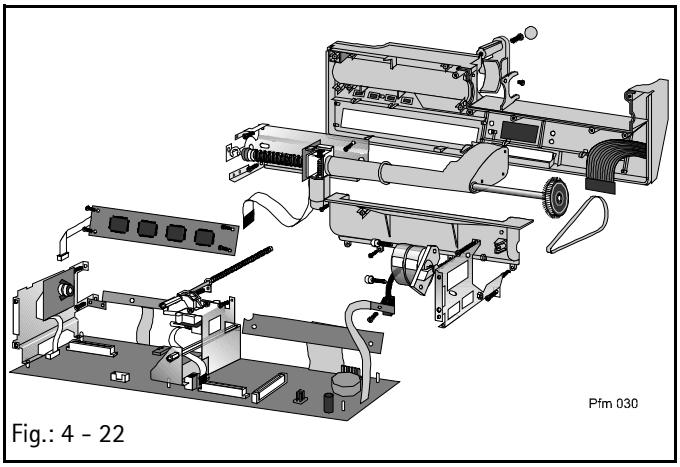


Fig.: 4 - 22

Designation	Ord. No.
Operating unit with seal cord, without LCD module	3450 7400
Seal cord, 600 mm (5 pcs.)	3477 4076
Label "Perfusor fm" (5 pcs.)	3477 3878
Dummy plate	3450 8244
Membrane keyboard (exchange)	3450 7329

Exchange

Tools: Screwdriver Pz 1 and 2, socket spanner, Allen key 2.5 mm, setting gauge for toothed belt tension, syringe and potentiometer gauges ("20 ml", "50 ml" and "max. 50 ml"),
Loctite 242 medium.

1. Remove cover (see „Housing Cover" ➨ pg. 4 - 5).
2. Remove motor.
3. Remove controller board and satellite boards.
4. Remove syringe holder with middle plate (see „Syringe Holder" ➨ pg. 4 - 3).
5. Unscrew side plate.
6. Remove recess.
7. Remove guide rail with drive.
8. Remove LCD-display.
9. Exchange the operating unit and assemble in reverse order.
10. Adjust toothed belt tension with gauge.
11. Stick on type plate.
12. Safety paint M4 screw and safety seal (unit rear).

Check

New alignment. Completely perform the procedure under "Alignment" in the Service Program.

Check function and electrical safety (see „Checks after Repair" ➨ pg. 5 - 1).

4.26 Controller Board with Satellite Boards

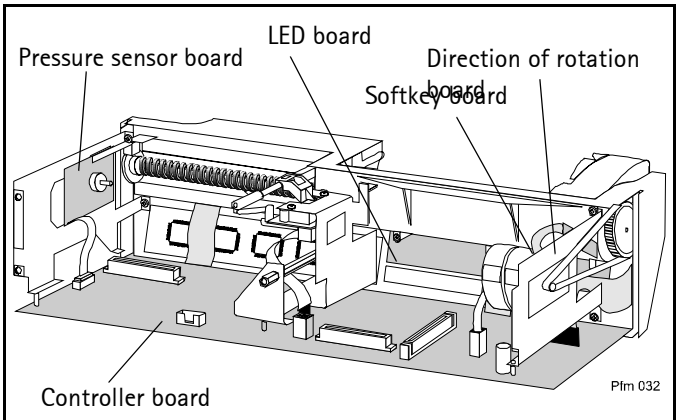


Fig.: 4 - 23

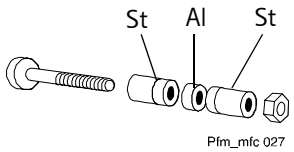


Fig.: 4 - 24 Coil core

The calibration data of the drive unit is stored in the EEPROM on the controller board. It must be determined after every board exchange. Enter the unit data of the old controller board in the new component.

Especially the DIANET and the serial number must be entered, because they are necessary for the interface mode (enter in Service Program under Unit Data after exchange is completed). If the pressure sensor board was exchanged use new split rivets for assembly (must audibly snap in).

Designation	Ord. No. Exchange	Ord. No. New Part
Controller board complete, language group (see „Language Groups" ➨ pg. 2 - 5)		
Group A	3488 0615 / 3450 7493	
Group B	3450 7361	
Group C	3450 7370	
Group D	3450 7381	
Group E	3450 7396	

Exchange

Tools: Syringe gauge

1. Remove cover (see „Housing Cover" ➨ pg. 4 - 5).
2. Dismount stepper motor (see „Stepper Motor" ➨ pg. 4 - 10).
3. Pull connector off the controller board:
   Membrane keyboard, syringe recognition (see „Syringe Recognition" ➨ pg. 4 - 12) and zero force connector.
4. Remove coil core from pressure sensor. Remove all screws from the satellite board, carefully remove the snap-in hooks and remove boards.
5. Remove spacers from the assembly plates and exchange complete board.
6. Assembly is done in reverse order. Push coil core on coil core screw and safety lock nut with Loctite 242 medium.

Check

Align drive unit and delete old calibration data prior to alignment. Completely calibrate the unit.

Check function (see „Checks after Repair" ➨ pg. 5 - 1).

4.27 Analog Board

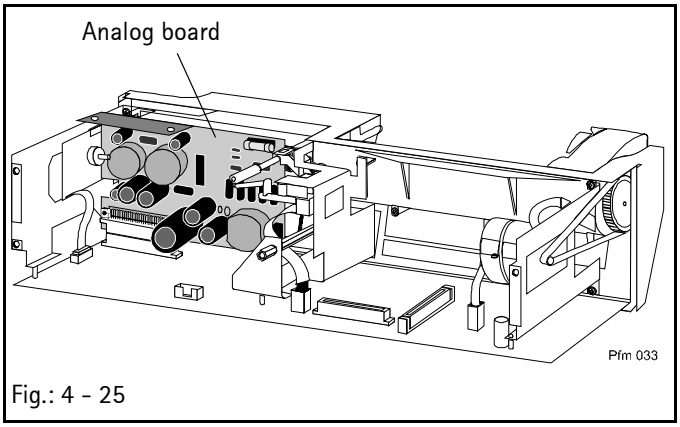


Fig.: 4 - 25

Designation **Ord. No.**

Analog board 3450 7485

Exchange

1. Dismount power supply module (see „Mains Transformer" ➨ pg. 4 - 4).
2. Pull out analog board and exchange board.

Check

Check electrical safety (see „Checks after Repair" ➨ pg. 5 - 1).

Charge battery and operate unit in battery mode until a pre-alarm is triggered.

4.28 Extensions

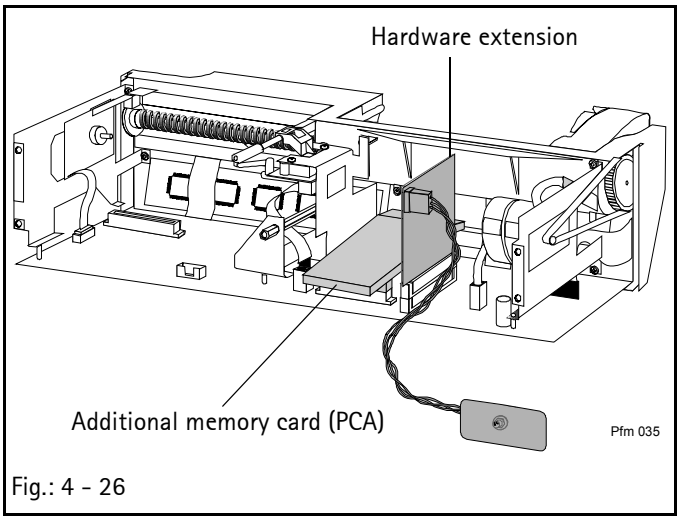


Fig.: 4 - 26

The extension port (e.g. with PCA) is the unit interface for hardware extensions. The basic functions of the unit remain unchanged for extensions. All parts offered are defined as accessories (see „Accessories" ➨ pg. 1 - 7).

For your notes:

Checks after Repair 5

Depending on the work carried out, perform the relevant check blocks (1., 2., and / or 3.).

1. Visual Inspection

- ❒ Unit clean, complete, undamaged
- ❒ Membrane keyboard, rubber feet
- ❒ Syringe fastening: Adapter, syringe holder, claw holders, push-button sensor
- ❒ Mains cable and mains plug connector
- ❒ Staff call / DIANET cable and connector
- ❒ Holder for pole fixation

2. Safety Check
according to IEC/EN 60 601-1

- ❒ Measure mains voltage _____ V AC
- ❒ Protective conductor resistance incl. mains cable < 0.2Ω _____ Ω
- ❒ Insulation resistance >> 2 MΩ _____ Ω
- ❒ Earth leakage current ≤40 µA _____ µA
- ❒ Patient leakage current ≤5 µA _____ µA

3. Functional Inspection

Switch on unit:
- ❒ Self-test
- ❒ Control lamps / alarm LED / audible alarm

Compare with display:
An error in the display of characters is safety-relevant
- ❒ Set delivery rate
- ❒ Set volume
- ❒ Set time

Battery test:
Charge battery and repeat test when the message "Battery discharged" appears
- ❒ Switch mains/battery/mains
- ❒ Switch on in battery mode and check self-test

- ❒ Staff call

The following staff call modes can be selected in the Service Program if the unit is switched off: static, dynamic with and without alarm.

- ❒ Check syringe holder alarm

Pressure cut-off
With manometer and 50 ml syringe.
Press. sensor press. stage 9
- ❒ 1.0 +/- 0.2 bar

Mech. pressure limitation
Service Program "Test Current Step"
- ❒ Current step 0 <1.0 bar
- ❒ Current step 1 <1.3 bar
- ❒ Current step 2 <1.6 bar

or

Pressure cut-off
With current step gauge Order - No. 0770 1616
Press. sensor press. stage 9
- ❒ 62 +/- 16 N

Mech. pressure limitation
Service Program "Test Current Step"
- ❒ Current step 0 <55 N
- ❒ Current step 1 <75 N
- ❒ Current step 2 <90 N

Syringe size recognition
- ❒ 10 ml*
- ❒ 20 ml
- ❒ 50 ml

* Permissible only with 10 ml adapter (Order - No. 0870 0117)

Observe the procedure information (see „Procedural Instructions for Inspection" ➨ pg. 8 - 1)!

5 Checks after Repair

For your notes:

Maintenance 6

It is recommended every 2 years. In addition to the technical safety inspection, the following assemblies/components are to be checked:

1. Check rubber feet and if necessary exchange.
2. Check handle and locking of the fm holder and if necessary clean.
3. Check push-button sensor (leakage / smooth running).
4. Check function of claws and claw motor and clean if necessary.
5. Check function and smooth running of drive.
6. Open unit, internal visual inspection.
7. Check toothed belt tension and align if necessary.
8. Grease polished part of the spindle (only with high vacuum silicone grease Order - No. 3450 7930).
9. Assemble and seal unit ready for operation.
10. Perform alignment of drive (see „Drive Function 0400" ➨ pg. 3 - 11).
11. Perform alignment of syringe recognition (potentiometer alignment) (see „Potentiometer Function 0410" ➨ pg. 3 - 12).

6 Maintenance

For your notes:

Technical Safety Check TSC

Index h
(Master - to be added to the documentation)

Checklist for Technical Safety Check – Every 24 Months

Unit: Infusion syringe pump Perfusor® fm
Manufacturer: B. Braun Melsungen AG

User

Observe the Service Manual and the instructions for use. All measured values are to be documented. Accessories used should be included in testing. Make exclusive use of calibrated measuring instruments.

Article No.	Unit No.	Year of Procurement

1. Visual Inspection

- ❒ Unit clean, complete, undamaged
- ❒ Membrane keyboard, rubber feet
- ❒ Syringe fastening: Adapter, syringe holder, claw holders, push-button sensor
- ❒ Mains cable and mains plug connector
- ❒ Staff call / DIANET cable and connector
- ❒ MFC line and plug connector (depending on unit type)
- ❒ Holder for pole fixation

2. Accessories Used

- ❒ Staff call lead
- ❒ _____
- ❒ _____

3. Functional Inspection

Switch on unit:
- ❒ Self-test
- ❒ Control lamps / alarm LED / audible alarm

Compare with display:
An error in the display of characters is safety-relevant
- ❒ Set delivery rate
- ❒ Set volume
- ❒ Set time

Battery test:
Charge battery and repeat test when the message "Battery discharged" appears
- ❒ Switch mains/battery/mains
- ❒ Switch on in battery mode and check self-test

- ❒ Staff call

The following staff call modes can be selected in the Service Program if the unit is switched off: static, dynamic with and without alarm.

- ❒ Check syringe holder alarm

Pressure cut-off
With manometer and 50 ml syringe.
Pressure sensor pressure stage 9
- ❒ 1.0 +/- 0.2 bar

Mechanical pressure limitation
Service Program "Test Current Step"
- ❒ Current step 0 <1.0 bar
- ❒ Current step 1 <1.3 bar
- ❒ Current step 2 <1.6 bar
- ❒ Current step 3 <1.9 bar[2]

Pressure cut-off
With current step gauge Order - No. 0770 1616
Pressure sensor pressure stage 9
- ❒ 62 +/- 16 N

Mechanical pressure limitation
Service Program "Test Current Step"
- ❒ Current step 0 <55 N
- ❒ Current step 1 <75 N
- ❒ Current step 2 <90 N
- ❒ Current step 3 <115 N[2]

Syringe size recognition
- ❒ 10 ml*
- ❒ 20 ml
- ❒ 50 ml

* Permissible only with 10 ml adapter (Order - No. 0870 0117)

4. Safety Check

according to IEC/EN 60601-1
- ❒ Measure mains voltage ____ V AC
- ❒ Protective conductor resistance incl. mains cable < 0.2Ω ____ Ω
- ❒ Insulation resistance >> 2 MΩ ____ Ω
- ❒ Earth leakage current ≤40 µA ____ µA
- ❒ Patient leakage current[1] ≤5 µA ____ µA

[1] not required on Perfusor fm with MFC connector (from serial no. 20.000)
[2] do not run on Perfusor fm from serial no. 20.000 on

Infusion line used for Technical Safety Check:
Type: _____Manufacturer: _____

Test result: Defects found which could endanger patients, users or third parties: ☐ Yes ☐ No

Measures to be taken: ☐ Repair

☐ _____

Special features / Documentation:

Inspection performed by:

Unit handed over to/on:

Date / Signature:

Next deadline:

For your notes:

M635 00 00 21 F04 / 3890 9421 (GB)
Perfusor® fm, 2.0 gb

Procedural Instructions for Inspection 8

Check:

Visual Inspection

Check correct locking of both claw holders by slightly pulling them out with a finger.

There must be no cracks in the area of the push-button sensor.

Functional Inspection

Switch-on test:

Check correct sequence.

Alarm tone, display of all pixels in text-display, brightness, contrast.

Rate display 000.

Battery test:

Running time with charged battery (small rates) > 30 min.

Staff call:

- Operation: Pin 3 and 5 connected. Pin 1 and 3 open.
- Alarm: Pin 1 and 3 connected. Pin 3 and 5 open.

Pressure cut-off:

Insert a 50 ml OPS syringe which is connected to a vented manometer. Activate in pressure stage 9 until pressure limit is reached. Monitor!

The displayed pressure is immediately reduced after activation of the pressure cut-off, due to the automatic bolus reduction.

Note

The current step gauge (Order - No. 0770 1616) can also be used instead of the syringe/manometer. Do not mix-up with the drive calibration gauge.

Syringe size recognition:

A 10 ml syringe must not be recognized without the 10 ml adapter.

Larger syringes should not be recognized with the 10 ml adapter. Possibilities to disable (see „Syringe Selection Function 0360" ➡ pg. 3 - 9).

Safety Check

Protective conductor resistance:

Measuring point potential equalization bolt, fm connector (bottom pin), heatsink assembly screw.

Insulation resistance:

Measurement with 500 V between shorted mains connectors and unit housing.

Earth leakage current:

Measurement under standard conditions at the protective conductor of the mains cable. Two measurements (one with reversed polarity). Document the largest value.

Distance of Operating Unit

Check distance of operating unit after each assembly (tolerance range 4.3 ... 4.8 mm):

Note

An incorrect distance can lead to a jammed drive and an incorrect syringe recognition.

1. Insert the distance gauge with dial gauge.
2. Check distance.
3. If the minimum distance is fallen below the distance can be adjusted by placing a shim under the hexagon tie rod (see „Middle Assembly Plate C" ➨ pg. 4 - 11).

Note

Do not set the dial gauge to zero! The dial gauge was calibrated and sealed by the manufacturer. A new calibration can only be performed in the B. Braun calibration laboratory.

Potentiometer Alignment	Align the potentiometer. Insert 20 ml, 50 ml, and max. 50 ml gauges. All 3 gauges must be correctly recognized (<< arrows appear). **Note** If a 10 ml adapter is used the arrow symbol can appear without an inserted 10 ml syringe.
Functional Inspection	According to the performed repair.
Electrical Safety	See TSC-List and the Procedural Instructions for Inspection.

For your notes:

Test Equipment and Special Tools 9

Test Equipment

For Repair / for TSC

Designation	Ord. No.
Drive alignment gauge	0770 1535
Distance gauge with dial gauge	0770 1608
Setting gauge for toothed belt tension	0770 1675
Potentiometer gauge 20ml	0770 1543
Potentiometer gauge 50ml	0770 1551
Potentiometer gauge max. 50ml	0770 1624
Current step gauge	0770 1616
Manometer 0 to 4 bar	0770 1357
Service connector (red)	0770 0709

Special Tools

Designation	Ord. No.
Special socket spanner M18	0770 1497

Consumables

Designation	Ord. No.
Loctite 242 medium	3450 7752
Loctite 274	on request
Locking compound	on request
High-vacuum silicone grease	3450 7930

9 Test Equipment and Special Tools

For your notes:

Spare Parts List 10

	Designation	Ord. No.
Perfusor® fm	Fuse T 0.315 A for 230 / 240 V (10 pcs.)	3477 0534
	Fuse T 0.63 A for 110 / 120 V (10 pcs.)	3477 0267
	1.8 Ah battery (hightemp)	3450 6357
	Rubber feet (set of 4 pcs.)	3477 3983
	Unit feet left, complete	3450 7671
	Unit feet right, complete	3450 7680
	Adapter for 20 ml to 50 ml syringes	3450 7540
	Adapter for 10 ml syringe	3450 7558
	Syringe holder without blind plug	3477 3843
	Mains transformer 200-240 V without wiring	3450 7450
	Connector label E (200 - 240 V)	on request
	Mains transformer 100-120 V without wiring	3450 8023
	Connector label E (100 -120 V)	on request
	Housing cover with labelling and unit feet	
	German	3450 7426
	French	3450 4460
	Dutch	3450 7779
	Italian	3450 7787
	English	3450 7795
	Spanish	3450 7809
	Danish	3450 7817
	Norwegian	3450 7829
	Swedish	3450 7833
	Finnish	3450 7841
	Portuguese	3450 7850
	Czech	3450 7868
	Polish	3450 7876
	Castellano	3450 7884
	Turkish	3450 7892
	Quick reference guide	3452 1291
	Unit holder complete incl. twist-snapper	3450 7655
	Hinge hooks	3477 3924
	Assembly plate battery module	3450 7477
	Potential equalization bolt	3477 0550
	Recessed plug	3450 5644
	fm recessed plug (3 pin)	3477 3177
	Rear panel board	3450 7582

10 Spare Parts List

Assembly plate power supply module. 3450 7442
Left assembly plate (web plate) 3450 7647
Stepper motor. 3450 7566
Right assembly plate (motor support) 3450 7620
Middle assembly plate (middle plate) 3450 7639
Potentiometer board 3450 7507
Microswitch 3450 7523
Potentiometer 2x10 kOhm 3450 7515
Reversing lever for potentiometer 3450 7604
Recess for syringe. 3450 7590
Drive unit complete with claw motor and
seal ring, without stepper motor 3450 7434
Claw motor, cpl. 3450 7922
Counter reverse washer (bronze) 3477 4033
Spacer ring 3450 7914
Needle bearing 3450 7906
Counter washer 3477 4025
Locking washer 3.2 mm (20 pcs.) 3477 4017
Recess for syringe. 3450 7590
LCD module board 3450 7418
Guide rail 3917 5880
Operating unit with seal cord, without LCD module . 3450 7400
Seal cord, 600 mm (5 pcs.) 3477 4076
Label "Perfusor fm" (5 pcs.) 3477 3878
Dummy plate 3450 8244
Membrane keyboard (exchange) 3450 7329
Controller board complete,
language group (see „Language Groups" ➡ pg. 2 - 5)
Group A . . . . . 3488 0615 / 3450 7493
Group B 3450 7361
Group C 3450 7370
Group D 3450 7381
Group E 3450 7396
Analog board 3450 7485

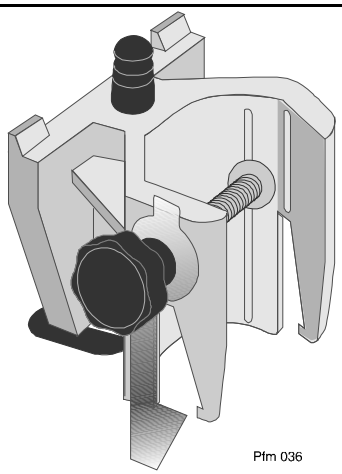


Fig.: 10 - 1 Universal clamp (Pole clamp)

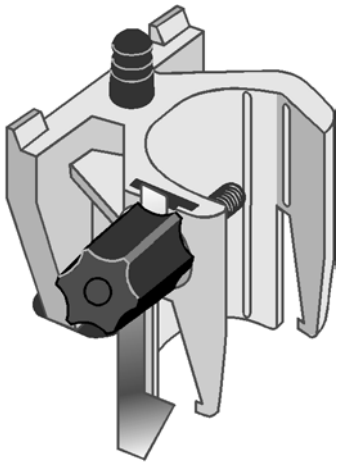


Fig.: 10 - 2 Universal clamp

Designation	Ord. No.
Pole clamp	
Pole clamp (universal clamp, rotating)	3450 9054
Universal Clamp (Pole clamp)	
Universal clamp, complete	3450 5857
Universal clamp	3450 8325
Threaded rod	3450 8333
Star handle body	3450 8384
Locking box	3450 8341
Locking hook	3450 8368
Plate (2 pcs.)	3450 2610
Connection cap D12/4 (5 pcs.)	3477 4149
Bellows (5 pcs.)	3477 3274
Pressure spring (5 pcs.)	3477 4165
Universal Clamp	
Universal clamp, complete	not available any more
Threaded rod	34 50 5903
Safety hook	34 50 5865
Turning handle	Upon request
Rubber cover (5 pcs.)	34 77 3290
Bellows (5 pcs.)	34 77 3274
Connection cap (5 pcs.)	34 77 3304
Pressure spring for pole fixation (5 pcs.)	34 77 3282

For your notes:

Appendix A

Revision Service-Documentation

Version2.0

This Service Manual was approved by B. Braun on 27.04.2006.

This manual has been completely revised. The most important changes are listed below:

- Changed manual structure
- Total list of spare parts

Current Information

A Appendix A

For your notes: